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50x VPN

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New look *APC*

A fresh makeover for your mag

Welcome to a particularly shiny new issue of *APC*. Our talented Creative Director Troy has given all our pages a clean scrub, and the end result is a refreshing new look for your favourite tech mag. As always, we've focussed on clean design and easy readability, all while being just a bit nicer to look at. It's a lovely new set of clothes, but the content itself remains the same great *APC* that's made the mag a winner. Do let me know your thoughts if there's something here you really love – or don't. Your feedback is always so important to us. Shoot me an email at ben.mansill@futurenet.com if there's anything I need to hear – my inbox is always open!

Inside this issue is a bumper collection of features, guides and reviews. Starting with our Wi-Fi security guide. This covers all your main devices, not just the PC. It's so important to examine how you have your security set up from time to time, so if we may suggest – now is that time. Hackers are constantly evolving their tools and methods, and any time spent putting our tips into practise with your gear could just end up being the difference between a happy life or grief and strife. This is important stuff!

Sticking to the same theme, we thought now would also be a great time to take a fresh look at the best password managers out there. The cost to sign up to one of these is negligible – or even zero – but neglecting password security can be potentially devastating. They're surprisingly effortless to set up and run, too.

We've also put together a guide for your Windows 10 options, if you're still running that OS. One option is to just stick with it, but as we spell out, there are compelling reasons to upgrade. Windows 11 has proven itself worthy, all the painful bugs have been ironed out and we do recommend upgrading. But beyond sticking with Windows 10, or upgrading to 11, there is a third option, and that's Linux. Running Microsoft software isn't cheap, and it could well be that your needs are met perfectly well with Linux. How to know for sure? Take a gander at our feature starting on page 70 and find out!

We hope the year is winding up well for you. It's been a big year for everyone, and the team at *APC* wishes you and your family all the best as we enter the very welcome holiday period.

"Hackers are constantly evolving their tools and methods, and any time spent putting our tips into practise with your gear could just end up being the difference between a happy life or grief and strife."

Exclusive downloads

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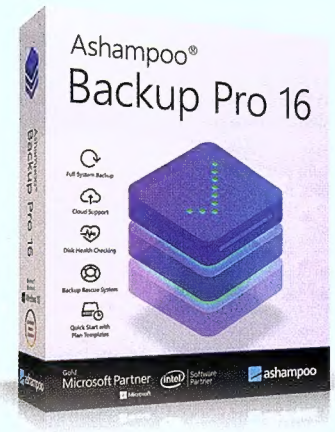

ASHAMPOO BACKGROUND REMOVER

AUTO-CROP AND EDIT OBJECTS AND SWAP BACKGROUNDS.

Ashampoo Background Remover crops persons and objects automatically thanks to smart object detection – no manual editing required in many instances. Detected objects can be saved individually or copied to the system clipboard for use with other programs. Even minute details are recognised, like strands of hair. Users can also replace image backgrounds or apply a stylish Bokeh effect. This makes it easy to visually emphasise or put people in completely new scenes. Manually adding or removing objects takes only a few strokes with the built-in correction brush. Ashampoo Background Remover is the time-saving solution for beginners and professionals alike to crop/share objects and replace image backgrounds, no learning curve required.

ASCOMP IMAGE FORMER

BATCH-EDIT AND CONVERT IMAGES WITH EASE.

Do you know the phenomenon of the leaking sea? It arises when you want to capture a sunset on the beach with your digital camera, but don't straighten the horizon. So later you get the impression that the sea is about to run out – what a shame about a unique motif!

With Image Former you can get your pictures in top shape in no time at all: select any number of pictures, define actions and start conversion. Whether you want to rotate images, crop edges or correct colors, Image Former automatically applies the changes you want to all selected images. The Windows tool also has full control of enlarging or reducing the size and brings your image files into the desired format quickly and easily.

ASHAMPOO BACKUP PRO 16

BACKUP SOLUTION TO CREATE AND RESTORE FILES AND ENTIRE DISK PARTITIONS.

Ashampoo Backup Pro 16 is Windows-based a comprehensive backup solution to back up or restore any file, partition or bootable operating system. Archives can easily be restored in the event of hardware issues or system malware infections. Backups can be created fully automatically thanks to smart background technology that does not interfere with normal PC operation.

For that, Ashampoo Backup Pro 16 monitors the system load and only becomes active when enough resources are available. Four selectable compression methods and strong encryption ensure space-efficient and secure backup archives. Users have total control over the storage location and medium, from traditional hard disks to online cloud services for maximum accessibility – and this applies to both individual files and entire disk partitions.

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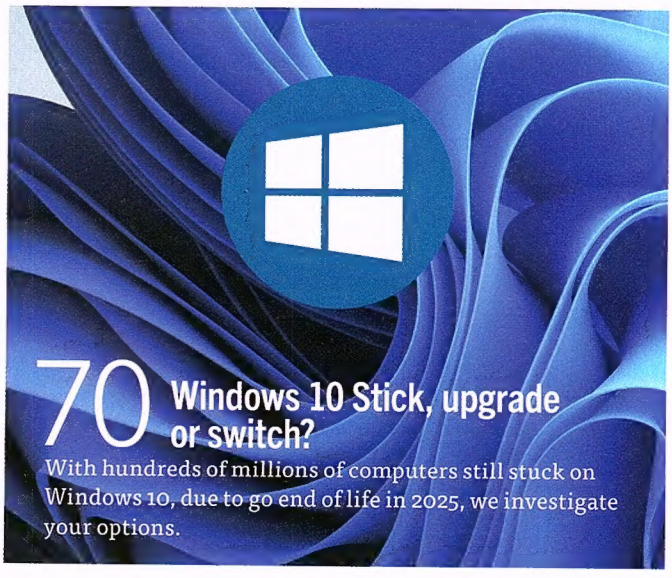
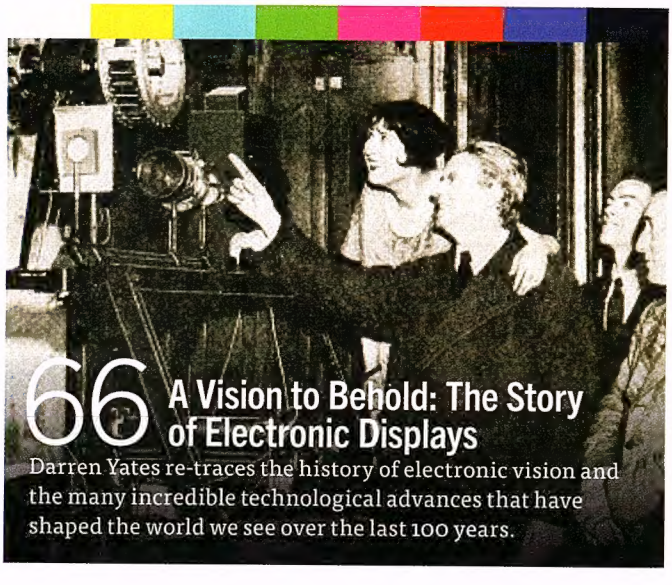


70 **Windows 10 Stick, upgrade or switch?**
With hundreds of millions of computers still stuck on Windows 10, due to go end of life in 2025, we investigate your options.



66 **A Vision to Behold: The Story of Electronic Displays**
Darren Yates re-traces the history of electronic vision and the many incredible technological advances that have shaped the world we see over the last 100 years.

It seemed innocent enough. The air-conditioning system needed its annual service. This was never particularly onerous – check the pressure levels, clean the air filters, give it a good spray of some suitably pungent smelling gloop.

Jon Honeyball - **One more thing**
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TECHNOTES

Everything you need to know from the month in tech

Intel's new 14th Gen Core series for desktop

Core i9-14900K, i7-14700K & i5-14600K.

Intel has announced its 14th Generation Core desktop processors. Aptly codenamed Raptor Lake Refresh, these new chips are based on Intel's existing Raptor Lake silicon – which was used in their 13th generation chips – with Intel tapping further refinements in manufacturing and binning in order to squeeze out a little more performance from the silicon.

Up to 6GHz

Headlining the new lineup is Intel's latest flagship desktop processor, the Core i9-14900K, which can boost up to 6GHz out of the box. This is the second Intel Raptor Lake chip to hit that clockspeed – behind their special edition Core i9-13900KS – but while that was a limited edition chip, the Core i9-14900K is Intel's first mass-produced processor that's rated to hit 6GHz. Under the hood, the i9-14900K uses the same CPU core configuration as the previous Core i9-13900K chips, with eight Raptor Cove performance (P) cores and 16 Gracemont-based efficiency (E) cores, for a total of 24 CPU cores capable of executing on 32 threads.

Moving down the stack, arguably the most interesting of the chips being announced is the new i7-tier chip, the Core i7-14700K. Intel's decision to bolster the core count of its Core i7 is noteworthy: the i7-14700K now boasts 12 E-cores and eight P-cores, four more E-cores than its 13th Gen counterpart – and only four behind the flagship i9. With base clock rates mirroring the previous generation's Core i7-13700K, the additional efficiency cores aim to add extra range in multitasking capabilities, designed to benefit creators and gamers.

Rounding out the 14th Gen Core collection is the i5 series. Not much has changed between the latest Core i5-14600K and the Core i5-13600K, with the only differences coming in E-core turbo frequencies; just a 100MHz uptick here. Both families share the same 6P+8E (20T) configuration, 5.3GHz P-core turbo, and 3.5 GHz P-core base frequencies.

AI Assist

Since the Intel 14th and 13th Gen core series are essentially the same chips but with slightly faster frequencies, Intel has made no changes to the underlying core architecture. Intel does include a new overclocking feature for users looking to overclock their 14th Gen Core i9 processors. Dubbed 'AI Assist,' it enhances things through its Extreme Tuning Utility (XTU) overclocking software. Harnessing AI to provide users with more intelligent options for overclocking settings outside of the traditional look-up tables based on set parameters, Intel's AI Assist goes further. Using various systems with various components such as memory, motherboards, and cooling configurations to train the AI model, Intel claims its in-house AI is constantly being trained to offer users the most comprehensive automatic overclocking settings thus far.

Intel boasts up to 23% better gaming performance with their in-house testing than Intel's 12th Gen Core series.

The Intel 14th Gen chips are designed for the pre-existing 600 and 700-series motherboards, which use the LGA 1700 socket. Motherboard vendors have already begun refreshing their Z790 offerings with more modern features, such as Wi-Fi 7 and Bluetooth 5.4, providing motherboard manufacturers decide to integrate them into their refreshed Z790 models. Official memory compatibility remains the same as 13th Gen, supporting DDR5-5600 and DDR4-3200 memory. Though overclockers may find the highest binned chips more capable than before, with Intel teasing speeds beyond DDR5-8000 for their best binned chips.

Intel 14th Gen Core, Raptor Lake-R (K/KF Series)

	Cores P+E/T	P-Core Base	P-Core Turbo	E-Core Base	E-Core Turbo	L3 Cache (MB)	iGPU	Base W	Turbo W	Price
i9-14900K	8+16/32	3200	6000	2400	4400	36	770	125	253	$989
i9-14900KF	8+16/32	3200	6000	2400	4400	36	-	125	253	$939
i9-13900K	8+16/32	3000	5800	2200	4300	36	770	125	253	$899
i7-14700K	8+12/28	3400	5600	2500	4300	30	770	125	253	$699
i7-14700KF	8+12/28	3400	5600	2500	4300	30	-	125	253	$679
i7-13700K	8+8/24	3400	5400	2500	4200	30	770	125	253	$659
i5-14600K	6+8/20	3500	5300	2600	4000	24	770	125	181	$529
i5-14600KF	6+8/20	3500	5300	2600	4000	24	-	125	181	$499
i5-13600K	6+8/20	3500	5300	2600	3900	24	770	125	181	$499

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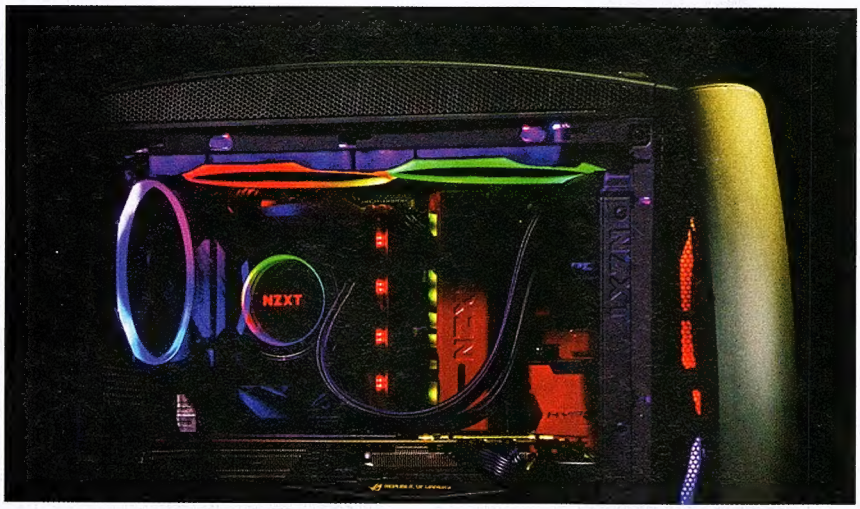

WINDOWS 11'S RGB CONTROL FINALLY AVAILABLE

The dream of a unified RGB ecosystem takes a giant leap forward.

Direct RGB control via Windows has been teased for some time. It's been present in Windows Insider builds for several months, and now it's available to the public. It's set to solve one of the most irritating and unnecessary bugbears of RGB-equipped systems. The idea behind it is to unify RGB control across your system, lessening the need to install multiple bloated or poorly functioning third-party apps.

The Dynamic Lighting menu includes a fairly rudimentary set of features. Firstly, the feature is optional, and the apps for your various devices can be set to override the Windows settings. You'll find options for brightness and a list of six different effects with a speed control. You can choose from pre-set colours, or customise your own from the RGB or HSV colour space. Both have six-digit hex code support. That's a good start, and it should cover most users' requirements, but for now, custom effects are generally superior via third-party apps.

There are many prominent vendors that have – or will have support. These include Acer, Asus ROG, HP, Logitech, Razer and SteelSeries.

> "The idea behind it is to unify RGB control across your system, lessening the need to install multiple bloated or poorly functioning third-party apps."

NVIDIA HINTS AT DLSS 10 FULL NEURAL RENDERING

POTENTIALLY REPLACING RASTERISATION AND RAY TRACING.

A future version of DLSS is likely to include full neural rendering, hinted Bryan Catanzaro, a Nvidia VP of Applied Deep Learning Research. Catanzaro recently discussed the topic of full neural rendering. This idea isn't quite as far out as it may seem. At the NeurIPS conference in 2018, Nvidia researchers showed an open-world demo of a world being rendered in real-time using a neural network. During that demo the UE4 game engine provided data about what objects were in a scene, where they were, and so on, and the neural rendering provided all the on-screen graphics.

Catanzaro said "DLSS 10 is going to be a completely neural rendering system," he speculated. The result will be "more immersive and more beautiful" games than most can imagine today.

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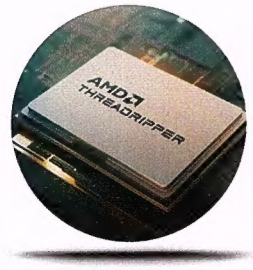


AMD BRINGS THREADRIPPER BACK TO THE DESKTOP

THE HEDT PLATFORM LIVES AGAIN!

AMD has announced the return of non-Pro Threadripper for desktops after killing it in the last generation, saying "We hear you, you're right, we brought it back."

It has now announced three new CPUs and accompanying TRX50 chipset motherboards. So, the high end desktop is back, with a super high price of entry, though you'll have to wait a few weeks as availability is scheduled for November 21.

AMD announced three of these non-Pro HEDT chips. They are the US$4,999 64-core 7980X, the US$2,499 32-core 7970X, and the US$1,499 24-core 7960X. AMD will launch six Threadripper Pro models and accompanying WRX90 motherboards too for the really serious CPU users. The Pro range is topped by the 7995WX, a 96-core monster of a chip.

CHATGPT UPDATE GIVES IT EYES AND EARS

IT EVOLVES...

The developers of ChatGPT announced on its blog that voice and image recognition capabilities are coming to ChatGPT. The company says "You can now use voice to engage in a back-and-forth conversation with your assistant. Speak with it on the go, request a bedtime story for your family, or settle a dinner table debate." Yes, you can set your grumpy uncle to argue with ChatGPT over dinner instead of yourself. We love it already.

A focus of the update has been to make the new speech-to-text and text-to-speech capabilities as lifelike as possible. The image support feature is no less interesting. OpenAI says you can "troubleshoot why your grill won't start, explore the contents of your fridge to plan a meal, or analyse a complex graph for work-related data".

The slow road to self-driving cars

Drivers were meant to be redundant by now. But as James O'Malley discovers, self-driving technology is quietly improving.

Not so long ago it felt like we were on the cusp of a transport revolution, as the promise of autonomous vehicles took hold. "You can count on one hand the number of years until ordinary people can experience this," said wildly optimistic Google co-founder Sergey Brin in 2014, who after making his billions created the company's X-Lab, which later spun out Waymo, to research autonomous technology.

And, of course, there was Tesla CEO Elon Musk. In 2015 he confidently predicted that within two years "full autonomy" would be achieved, and then a year later during a TED talk predicted that by the end of 2017, one of his company's cars would be capable of driving across the United States without the driver once having to touch the steering wheel.

Look out of the window, however, and you'll probably be there an awfully long time waiting for a self-driving car to pass by. The hyperbole has subsided and several major autonomy or autonomy-adjacent projects, such as Uber's Advanced Technologies Group or Ford's Chariot division, have been shuttered completely. "The problem is considerably harder than it was originally thought to be, and the business models might not make as much sense," said Mahmood Hikmet, head of research and development at Ohmio, a New Zealand-based 'intelligent transport' company.

You might have given up all hope of ever being driven around town by your own car. However, with a deal more modesty than before, the

technology has continued to slowly improve.

Cars on the road

Even though most of us don't see self-driving cars passing by our front door, they are starting to creep on to public roads. Google's Waymo robo-taxis are in routine operation on the streets of Tempe, Arizona. And earlier this summer, Cruise, a robo-taxi subsidiary of veteran car manufacturer General Motors was granted permission to run its vehicles, fully autonomously, on the crowded and chaotic streets of San Francisco.

Yet, even though these projects are starting to break cover, Hikmet remains sceptical of the robo-taxis that companies such as Waymo and Cruise are attempting to make a reality. "Unless you've got a big tech company backing you, it means that you can't fulfil those business cases because there's very little, if any, profit that could come out from that," said Hikmet.

"The technical complexity to go from [working] in a restricted area to 'Level 5', being able to work absolutely everywhere is a huge technical hurdle to jump," he added. "Is it worth it, money-wise? I'm not sure that it is."

Instead, he thinks the future is in autonomous public transport systems, and vehicles like autonomous buses. That's music to the ears of Jim Hutchinson, CEO of Fusion Processing, the company behind the autonomous driving system that is the brains behind the CAVforth trial. "I think people are being unduly pessimistic now," said Hutchinson.

He said the pace of change in the industry might be slower than first expected because "the initial expectation was it was a done deal, it was all going to be done in a couple of years".

Though progress may feel slower than it once did, it might ultimately be better that companies take their time, incrementally improving their technology. "With it being a [bus] service, it's not just running ad-hoc when there's people available. There's many, many buses running that service every day," said Hutchinson. "So, we're getting a lot more data on our system, but also a lot more data on the operational aspects, and most importantly, on the passengers and how they're responding to it."

He is well aware of the risks of applying the Silicon Valley mantra of 'move fast and break things' to vehicles on the road, having seen recent controversies in California, with complaints that robo-taxis are blocking emergency vehicles or access to certain streets. "If you try to go too far too soon, then inevitably you're going to run into problems, and I think that's what we're seeing now with some of the companies," he said.

"The jump from Tesla's "Level 2" autonomy, where the driver is expected to maintain vigilance at the wheel, to true "Level 5" autonomy might be trickier than many autonomy evangelists anticipate."

Bending the rules of the road

It's not only in public transport where progress is being made. When Tesla first launched its 'full self-driving' mode in 2020, social media was quickly flooded with footage of vehicles running red lights, veering across lanes and otherwise causing mayhem on the streets of the United States. But three years on, it's possible to find videos of lengthy trips where the driver doesn't once have to touch the wheel.

However, there is still a big challenge ahead for the technologists. The jump from Tesla's "Level 2" autonomy, where the driver is expected to maintain vigilance at the wheel, to true "Level 5" autonomy might be trickier than many autonomy evangelists anticipate.

Hikmet compares it to parents supervising their children at a swimming pool. Even if the parents don't have to jump into the pool to save a drowning child, it doesn't mean their presence wasn't necessary. Similarly, even if a Tesla is mostly driving itself, there is still a human who can slam on the brakes – which is a luxury that 'real' autonomous vehicles won't have.

And then there's the question of how to create vehicles that can handle strange, one-in-a-thousand chance events. On a large enough scale, even edge cases become commonplace. But training an autonomous system to deal with an animal jumping into traffic or police tape blocking the road can be tricky.

Hutchinson is confident his software will get there. "The vehicle knows how to put itself into a safe state, which may be as simple as pulling over onto the hard shoulder," he said. "It can do that safely in all situations and then it will await further instruction."

But what about the edge cases where a human driver will know to break the rules, like, say, driving on the pavement or into the opposing lane, to handle a difficult situation in the safest possible way. Can an autonomous system really be programmed to break the rules?

"In truth, there does have to be a little bit of flexibility here and there," said Hutchinson, "Obviously you want a vehicle that largely obeys the Highway Code."

But "largely" isn't "always". "There has to be a little bit of flexibility here and there otherwise it would be a little bit stuck in certain scenarios," said Hutchinson, keen to stress that the Highway Code is obeyed in all "normal" circumstances.

"There are some hard-and-fast rules which shall not be broken," said Hutchinson. "But then there are others where there's a few shades of grey in there."

However, Hutchinson was unsurprisingly reluctant to discuss specific situations when an autonomous vehicle may need to "nudge" the rules. "This is the real complexity in getting a system that works in the real world," he said. "The thing I would always say is safety is never compromised." ■

The fate of Bandcamp is in the balance

The internet's favourite music platform is being volleyed between greedy corps, and the story won't end well, writes Shaun Prescott.

Epic Games purchased Bandcamp in early 2022 for an undisclosed sum. It caused a lot of anxiety in the music world. For those unfamiliar, Bandcamp is a huge distribution platform for music. It's traditionally been favoured by smaller independent artists, but is nowadays also used by big name acts like Radiohead and Bjork as a means to sell direct to listeners.

It's primarily a platform for outright digital music sales, standing at odds with the big exploitative streaming services like Spotify whose piddling royalty system is completely unsustainable for artists not attracting multi-million listeners. Sure, Bandcamp takes a slice from each sale (15 percent on digital; 10 percent on physical goods purchased through their storefront) but it regularly holds "Bandcamp Friday" events during which the company takes no share at all.

The closest analogue to Bandcamp is Steam. Before Bandcamp, digital sales of music were mostly a fragmented mess. Sure, places like the iTunes Store, even Amazon, sell digital music, but... have you used iTunes lately? And like Steam, there's virtually no barrier to entry: anyone can upload their music to Bandcamp. And each digital purchase is held in a vault that can be accessed at any time or even streamed via the Bandcamp app. Before Bandcamp, it was the norm to download music from an artist website and never be certain that you'd be able to re-download it in the future.

In other words, a good – albeit imperfect – model used by millions, and probably the most artist-friendly mass market platform of the 21st century. So you can understand why Epic Games' purchase made artists bristle: One does not associate multi-billion dollar corps with the art-for-art's sake mentality of – at a rough estimate – 80% of Bandcamp's user base. When the purchase was made in March 2023, Epic Games didn't even really seem to know why it had bought Bandcamp. Bandcamp "will play an important role in Epic's vision to build out a creator marketplace ecosystem for content, technology, games, art music and more" it said at the time.

If Epic Games did have some grand plan for Bandcamp we may never find out what it was, because last month the company announced it would sell Bandcamp off to Songtradr, which describes itself as "the world's largest B2B music company". Sounds troubling! And it is: ahead of the sale Epic announced that 16 percent of Bandcamp's workforce would be laid off. According to Songtradr's CMO, "Bandcamp requires some adjustments to ensure a sustainable and healthy company that can serve its community of artists and fans long into the future."

That, of course, means that Bandcamp requires a calibration towards ever-ascending profits. Being merely "sustainable" is the antithesis of what a company like Songtradr or Epic wants. And so the same old story repeats: a beloved mainstay of a fast-antiquating vision of the internet is destroyed by hoovering, rapacious, capitalist pigs.

The problem is, founding Bandcamp in 2008 would have made a lot of sense. The internet has changed since then, and platforms are more centralised than ever. Could an alternative ever achieve the same critical mass? The overwhelming cynic in me thinks no, not without a lot of money involved. One does not happen across a platform like Bandcamp organically anymore. It's unclear what Songtradr has in store for Bandcamp, but if the modern internet is any indication, it'll be terrible. ■

Shaun Prescott is an Australian editor for PC Gamer, GamesRadar and PLAY, and writes for APC, TechRadar and more.

Troubleshooting your feet

PCs are complicated systems, but sometimes we might be making problems seem harder than they really are.

As the lead systems reviewer at APC for the last nine-odd years, I've had my fair share of PC problems to troubleshoot and for the most part I reckon I'm pretty quick to diagnose and solve issues. One issue however has eluded me for years and in hindsight it's not even a particularly difficult one.

Sometimes my PC would drop highlighted text and move the positioning of the cursor in documents when I tried to copy things. It would also go through periods where I'd struggle to move web browsers or resize pages and clicking on specific buttons and shortcuts was like trying to squeeze a wet bar of soap. Basically all things to do with the mouse and cursor... but whether it was the fact that I had the issue across a couple of different mice or that I had been using a self-rebuilt hand-me-down Mobo with a 2nd RAM slot was given to me dead, I always assumed the dropping of highlighted text was some kind of CPU glitch.

"I'd struggle to move web browsers or resize pages and clicking on specific buttons and shortcuts was like trying to squeeze a wet bar of soap."

I spent countless hours searching for common processor issues that might cause such problems, downloaded tons of stress and performance testing software, updated all the drivers I could find and ran just about every kind of anti-virus software available. A set of solutions that would usually take so long to chip away at that the issue would fix itself before I'd finished.

When the issue cropped up again recently I went through the standard process of Googling it, only instead of searching for what I thought the problem was, this time I just typed in all the symptoms and came across something I hadn't found before. Turns out the 'Logitech double click' issue is prevalent enough to be labelled 'infamous' by some online articles and as I kept reading and everything continued to line up perfectly I was filled with a sense of joy at finally solving a conundrum that had been at the top of my first-world problems list.

The *Overclockers* article I first found about the Logitech double click problem offered detailed information on how to replace the sensor, a solution that definitely appealed since I liked the G903 Lightspeed wireless mouse and wouldn't mind fixing it when I had time. But the immediate solution of swapping it out allowed me to finish what I had to do and actually gave me the space to do some more research into the issue before embarking on a lengthy teardown process.

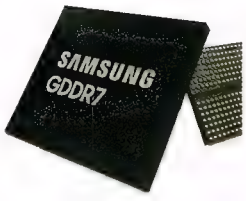
In this time I found an Amazon customer review that had over 500 helpful mentions about the cause and a simple fix for the Double-Click issue. Apparently it was caused by static electricity buildup and that simply breathing into the mouse button gap would add enough conductive, moist air to allow it to discharge and function normally again. To my complete surprise this unbelievably simple solution worked.

I'm not sure if the takeaway from this is to be cautious of your assumptions... or if it's a moral tale about why we wear those silly wristbands when putting a PC together. Heck it could even be to say if you stick with a problem long enough a solution will eventually fall in your lap. But whatever it is, it's worth remembering that even your most revered tech brands are capable of giving you grief, especially when you're not expecting it. ■

Joel Burgess is one of the senior journalists on APC magazine and apart from being the resident laptop, monitor and fitness tech geek, he's also pretty into surfing his local Sydney beach breaks when he's not in front of a screen.

VRAM ramping up

Samsung GDDR7 heads for 32Gbps.



Samsung already has GDDR7 memory modules in production, which seems like an easy pick for future GPUs and other devices.

DRAM is at the heart of many computing devices. Whether it's DDR4 and DDR5 in PCs, HBM2 and HBM3 in GPUs, or GDDR6 and GDDR6X in graphics cards, a lot of the building blocks remain the same. It's the signalling that get upgraded, and now GDDR7 is on its way, with Samsung modules in production and Micron's alternatives to arrive in 2024.

It's a safe bet that GDDR7 will end up in the next-generation AMD, Nvidia, and Intel GPUs. We don't expect any of those to start shipping until 2024 at earliest – Intel's Battlemage architecture will almost certainly be the first "next-gen" GPU to arrive – so we still have plenty of time. But the transition is otherwise right on schedule.

The first GDDR6 graphics cards launched in 2018 with Nvidia's RTX 20-series, with GDDR6 at 12–15.5 Gbps (GTX 1650 to RTX 2080 Super). AMD RDNA GPUs also used GDDR6, again ranging from 12–14 Gbps. Two generations later, the latest Nvidia Ada and AMD RDNA 3 GPUs have pushed GDDR6 speeds of 17–20 Gbps, with GDDR6X clocked as high as 22.4 Gbps for the Nvidia RTX 4080.

That represents a 43% increase in bandwidth per GDDR6 module over the past five years, but even the highest-rated 24 Gbps GDDR6 pales in comparison to GDDR7. Samsung indicated targets of 36 Gbps in late 2022, but production modules have base speeds of 32 Gbps – 33% higher than the fastest GDDR6, and 60% higher than the 20 Gbps chips used by AMD. It's a good thing, as even with large L2 and L3 caches, the latest GPUs are starting to run out of bandwidth.

With GDDR7, a future 384-bit memory interface would boast up to 1.536 TB/s of bandwidth. The RTX 4090, meanwhile, tops out at 1.008 TB/s, and the RX 7900 XTX offers 960 GB/s. Similar gains would be available on narrower interfaces as well, though costs might keep budget and mainstream devices on GDDR6 for another generation.

The initial Samsung GDDR7 modules come with a 16Gb capacity, like the GDDR6 and GDDR6X chips. That will likely be the lower limit for GDDR7, but the question is where the higher-capacity chips will go. 32Gb capacities seem likely, packing 4GB per chip. That would enable up to 16GB of memory on a 128-bit interface, or 48GB on 384-bit. Double the chips per channel, like Nvidia and AMD on professional GPUs, and 96GB GPUs are possible.

But 32Gb modules might not be the only higher-capacity options. In the past year, we've started seeing non-power-of-two DDR5 memory modules. That's thanks to 24Gb DDR5 modules, which enables up to 48GB DIMMs and 192GB total for four DIMM slot motherboards. Samsung hasn't confirmed that it will offer 24Gb GDDR7, but it might make for an in-between capacity.

We're not sure where mainstream consumer hardware with a 128-bit interface needs to go to 16GB total VRAM, but 8GB isn't always enough, and having the option for 12GB while sticking with a 128-bit bus could be useful. 256-bit interfaces, meanwhile, could offer 24GB, rather 32GB, while 192-bit and 384-bit configurations could offer 18GB and 36GB. Will we see those in future graphics cards? My crystal ball still looks hazy, but I wouldn't count them out. ■

"The initial Samsung GDDR7 modules come with a 16Gb capacity, like the GDDR6 and GDDR6X chips. That will likely be the lower limit for GDDR7, but the question is where the higher-capacity chips will go."

Jarrod has been described as an AI by people he meets at parties.

The right to repair movement has scored some big wins

If you own it, you should be able to fix it.

For too long, consumers have had to deal with devices that need to be thrown away, or returned to an expensive 'authorised repair center' to be fixed at too high a cost. Even something as simple as replacing a battery is all too frequently an impossible task. Some phones and laptops are harder to break into than Fort Knox. Manufacturers are all too happy to rake in the profits when you're forced to buy a new device instead of repairing an older one. It's planned obsolescence in action.

Things like custom tools, non-available replacement parts or proprietary software are things that prevent end users from extending the life of their devices. Thankfully, slowly but surely, world governments are waking up to these shenanigans and are introducing legislation to give users more control over the devices they own.

One of the most prominent examples of right to repair legislation has just been signed into law in California. That's important because California is home to some of the world's largest tech companies, including Apple. It requires manufacturers to provide appropriate tools, parts and diagnostic software support for devices for up to seven years if the item costs more than US$100. Devices that cost between $50 and $99.99 are required to have three years of support.

Other than these consumer benefits, a bill like this will help to cut down the amount of electronic waste. It will also provide a welcome boost for local repair stores. Increased competition is sure to lower costs as consumers will no longer be forced to visit expensive authorized repair centers.

Frustratingly though, the California legislation doesn't extend to game consoles and things like medical technology such as electric wheelchairs. I can imagine some lobbying behind the scenes to get those excluded.

The EU has passed its own right to repair legislation, while also requiring manufacturers to adopt the USB-C standard. That's a clear win for consumers as it will eventually mean all portable devices will use a common charging standard. The hope is that you won't need multiple chargers, leading to a further reduction in e-waste.

Australia has a long way to go, though. The Australian Productivity Commission released a report in 2021 that called for the government to introduce right to repair legislation, but other than some limited changes in the automotive sector, Australia remains a step behind.

On a personal note, I own a Dell XPS Ultrabook with 8GB of soldered RAM. It's a nice laptop, but being stuck with just 8GB of RAM is becoming a frustrating limitation. I would love to be able to install 16GB or 32GB of RAM in it and extend its life for a few more years, but alas, I cannot. That means I need to buy a new laptop sometime soon. I imagine most of you've had similar experiences with planned obsolescence.

The Californian legislation should eventually have a global impact. It's got a large population and its home to the headquarters of some very powerful companies. Rules in one jurisdiction should flow onwards. With luck, Australian consumers will one day be given more control over the devices they own. It'll be better for the hip pocket, simply standards, extend the life of your products and benefit the environment. ■

Chris Szewczyk has been elbow deep in PCs since before the turn of the millennium, and he wouldn't have it any other way.

There's no logic in these boards

Why does GPU pricing have to be so infuriating?

I noted a while back that prices of pretty much everything had normalised with the pandemic receding and other supply chain abnormalities subsiding. The one exception were GPUs. Several months later, while graphics cards are cheaper, they still haven't returned to historical trends. But what's even more frustrating is that pricing just doesn't make sense.

> "Call it bang for buck or frames per dollar, whatever you prefer, the value curve when it comes to all manner of electronics has always been the same."

The most recent example of this involves AMD's hot new Radeon RX 7700 XT and 7800 XT boards, but we'll come back to those GPUs in a moment. The overarching problem here, aside from the more obvious issue of painfully high pricing, involves comparative value for money. Call it bang for buck or frames per dollar, whatever you prefer, the value curve when it comes to all manner of electronics has always been the same. You get more for your money at the lower end of the market.

For a product like a GPU, that means the absolute best-of-the-best graphics card might be five times the cost of an entry-level board, but only offer two or three times the performance. Somehow, however, that value scaling up as you move down through the range has been lost of late.

It all started with Nvidia's RTX 40 Series graphics cards. If you start out at the top of the RTX 40 range, you'll find that the RTX 4090 only increased in price a little over the old RTX 3090, but offered a major performance boost. However, as you move down through the range to RTX 4080 through the 4070 and 4060 models, you will find that the price jumps are much bigger over the old 30 Series, but the performance increases shrink.

Long story short, the RTX 4090 is the best-value GPU in the RTX 40 Series when you're doing a generation-to-generation comparison. But when you compare, say, the 4060 Ti to the 4070 Ti, you don't get any more bang for your buck with the cheaper GPU.

The 4070 Ti is faster, but the price gap is pretty much proportional to the performance gap. That has never been the case with PC components in the past. Bang for buck always dwindled as you moved up the range, be that GPUs, CPUs, memory, or storage.

So we come back to those new AMD graphics cards. By AMD's own admission, the 7800 XT is at least 20 percent quicker than the 7700 XT, and often more than that. But the 7800 XT costs just 10 percent more than the 7700 XT. AMD's gaming graphics supremo, Scott Herkelman, justified that by saying, "$50 is a big deal for people who are looking at 7800 XT/7700 XT-class of GPUs."

But is $50 a "big deal" for people buying $500 GPUs? It's not totally inconsequential; it's pretty obviously 10 percent, which surely isn't that big a deal. Anyway, how AMD thinks that it makes sense for the more expensive GPU to offer better value I have no idea.

The 7800 XT looks like it will at best match the 6800 XT, so it would be a tough sell for much more than the last-gen GPU currently goes for. For my money, that isn't anywhere near big enough a gap, and AMD must know that. But then the GPU market as a whole has simply stopped making sense. AMD's new GPUs only underline that frustrating fact. ■

Jeremy has a black leather jacket just like Jensen's.

When hackers attack

Jon Honeyball tells the tale of a spy who came in with the cold.

It seemed innocent enough. The air-conditioning system needed its annual service. This was never particularly onerous – check the pressure levels, clean the air filters, give it a good spray of some suitably pungent smelling gloop. Move on to the next one.

It was only a few months later that strange things started to happen. Quotations to established clients weren't turning into orders. A surprise, but perhaps that's just the economy. But when that usual big quarterly order didn't materialise, it was time to phone the client to ask what had happened. It seems that a rival had undercut the firm. Not by much, but enough that it was hard to convince the financial director at the client to stay with the established supplier.

> "It was clear that the scope of the data exfiltration was all-encompassing. And the actions of the competitor, by being ahead of every move they took, was quite a smoking gun."

Disappointed, the firm continued work on its new design. This was going to be a significant improvement in the product, quite a step change. They were ready for the big launch at the annual trade show. The stand was looking immaculate, and the new product was ready to be unveiled.

And then something quite unexpected happened. That rival, to whom they had lost the account some months before, showed its new product. The similarities were striking. Only theirs was made in China, not Melbourne, and the price was shockingly low.

The company, already under big financial pressure from the ongoing effect of Covid shutdown, increased supplier costs, and difficulty in obtaining key items, could not continue. Within a few months, the doors closed when the money ran out.

It was when clearing the director's office that the IT crew spotted something odd. A small box, not much bigger than a box of matches, inserted into the Ethernet feed to the desktop computer. It was powered by a second, smaller inline box that took power from the power over ethernet feed, and fed it on USB to the main box. This was hidden away, under the director's desk, taped to the underside with some gaffer tape.

Closer inspection showed it was the new Mark2 version of the Hak5 Squirrel. It was inserted seamlessly between the desktop computer and the network. The scope of the packet sniffing, redirection and tunnelling was as subtle as it was devastating. The remote access via a VPN tunnel for the outside actor allowed for unhindered network access and packet capture on the wire.

It wasn't clear if the data went straight to the competitor or whether it had been sold on the black market, and then picked up by the competition. Nevertheless, it was clear that the scope of the data exfiltration was all-encompassing. And the actions of the competitor, by being ahead of every move they took, was quite a smoking gun.

This might seem a fanciful tale of Bond-esque espionage. But the equipment is there today and costs a trivial amount of money. Getting such a unit into place is not that difficult, if you consider the lack of security at the average office and the number of people who come in and out. There is a reason why people visiting my office, for routine tasks such as servicing the aircon, the alarm system or checking the fire extinguishers, are kept under observation.

So how well do you know your physical network? Who do you let into your offices, and who has unattended access? And what might you find taped to the underside of a desk if you were to go looking? ■

Jon Honeyball is more Johnny English than Jason Bourne.

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FUTURES

We explore the trends and technologies that are set to shape the future

Novelists deserve to be paid for training AI

Tech giants used pirated books to train their large-language models, but that doesn't mean you can ask ChatGPT for your own personalised Margaret Atwood story, says Nicole Kobie.

Step aside Margaret Atwood and Stephen King, here's a dystopian horror story for you: imagine spending years of your life toiling over a keyboard, carefully crafting sentences, paragraphs and chapters of a book that weaves together a plot, brings characters to life and enthralls readers for hundreds of pages. Now, watch as an AI eats it and spits your garbled works back at you.

Ever since OpenAI's ChatGPT brought large language models (LLMs) to the wider world's attention, it's been suspected that writers' work has been used to train them. LLMs are deep-learning systems with hundreds of millions of parameters that are taught to assemble sentences by hoovering up massive text datasets. Datasets such as most of the English-language internet, including Wikipedia.

Writers are speaking up. In June 2023, the American Authors Guild published a letter signed by thousands of members: "Millions of copyrighted books, articles, essays and poetry provide the 'food' for AI systems, endless meals for which there has been no bill. You're spending billions of dollars to develop AI technology. It is only fair that you compensate us for using our writings, without which AI would be banal and extremely limited." The UK's Society of Authors (SoA) has also submitted evidence to a House of Lords inquiry into the subject, calling to protect copyright.

In July 2023, a trio of writers – Christopher Golden, Richard Kadrey and Sarah Silverman – sued Facebook's parent company, Meta, and OpenAI for copyright infringement over the use of their books to train their AI models. The Meta case is

particularly interesting as the Facebook owner has revealed some of the datasets it used to train its LLaMA LLM, including both the copyright-free Project Gutenberg collection of ebooks and a publicly available dataset known as "The Pile", the suit notes (**tinyurl.com/APC526suitt**). And digital copies of their books are contained in that "pile", which wasn't compiled by Meta but was apparently used to train its LLM.

The Atlantic worked with a copy of that dataset to uncover if other authors were included, infringing their copyright – you won't be surprised to hear that it does. By searching for ISBNs, the identifying numbers used by the publishing industry, journalist Alex Reiner uncovered at least 170,000 books in the collection, from Zadie Smith and Elena Ferrante to Haruki Murakami and Margaret Atwood.

Some authors have said they're not all that bothered. King says he's not nervous, having seen the quality of output so far and being aware of his own advancing age – he'll be gone before the machines are good enough to replace him. Atwood would simply appreciate being paid, even if just the cost of her books – doesn't she deserve at least her royalties? Buy the lady a cup of coffee before stealing her work.

How did this happen?

Payment and consent is – at the moment – at the core of this training quandary. We've long known that the datasets used to train the largest LLMs have hoovered up everything they can from the English-language web, and it will come as no surprise that plenty of pirated books are out there.

Whether Meta, OpenAI or Google have used datasets that included pirated content, and whether that was knowingly or not, is likely an issue for courts to unpick. Indeed, newspapers including the New York Times are reportedly also considering legal action.

That's part of the problem: we don't know what datasets were used to train these machines or how they work. "They've been made behind closed doors, so we can't really check what they're doing and we can't look down the microscope and see what's happened in the background," said Lydia France, a research data scientist at the Alan Turing Institute. "There's so much it's been trained on that we can't actually get back to the original data – it's a bit like an egg that can't be unscrambled. You can't actually see what's gone in."

Compare that to proper academic science, which, through the peer review system, ensures there are plenty of eyeballs on new research, be it from a methodological or ethical standpoint. "With these big companies, they're just kind of free to do what they want, which is not great," she added.

It is possible to get an inkling of what's been included by asking very pointed queries; that's what the trio of authors did for their suit against OpenAI. But it's a difficult task because of the sheer quantity of text data, so it would be useful for companies to be more open about what datasets they do use – and they need to make an effort to ensure there's no copyright infringement before they use it, rather than later.

> "You're spending billions of dollars to develop AI technology. It is only fair that you compensate us for using our writings, without which AI would be banal and extremely limited."

However, France isn't optimistic: "They don't have any incentive to be open about any of this."

Bigger doesn't mean better

Making models ever bigger and feeding them from ever-expanding data collections has another problem: it's just plain lazy.

Deep learning has long worked to the axiom that more data means more accurate results, and to date that's held true. But what happens when we run out of data to feed these machines? "[This is] the issue of 'model collapse', which means that without human-authored works to learn from, we could get to a stage where AI-generated content forms the majority of the dataset ingested for future learning," said Society of Authors chief executive Nicola Solomon. "Researchers have found that this leads to 'irreversible defects' in the content that the model generates."

Isn't there a better way to operate? Big models processing big datasets chomps through energy. Cleaning up these datasets is nasty, manual work – sifting through hate speech and other disturbing content – that is handed to moderators in Kenya paid $2 an hour. Eating up everything leads to bias but also waste; after all, the collected works of Stephen King will only help you write a better sales presentation if you work for one heck of a horrifying company.

But writing better models and using curated datasets may not solve the problem. The "hallucinations" and other factual errors spat out by these LLMs are core to their operations. The only way to get something new from them, and not just the same sentences repeated over and over, is to dial up the randomness in the model.

"But that's exactly what's injecting utter nonsense a lot of the time," said France. "It's quite hard-baked into the way that these things work. It's not like we can just sort that bug and it will be fine." To fix that, we need to add decision-making and reasoning capabilities, not just chuck more data into the mix.

Can AI write a novel?

Atwood is wrong on one point. In her *Atlantic* essay, the Canadian literary giant notes: "Once fully trained, the bot may be given a command – 'Write a Margaret Atwood novel' – and the thing will glurp forth 50,000 words, like soft ice cream spiralling out of its dispenser, that will be indistinguishable from something I might grind out. (But minus the typos.)"

That's not possible now and perhaps never will be in the future. For a start, ChatGPT's word limit is around several hundred words, as it runs the older model, GPT-3.5. The newer model, GPT-4, can reportedly handle as many as 25,000 words in one go. But such AI systems cannot

hold the thread of a novel for 50,000 words, let alone develop the plot, character and the rest – there's more to writing a novel than simple word count, after all.

These models take your queries as input and spit out a probable sequence of words. ChatGPT can pull in previous queries and large blocks of text as input, known as tokens, to inform its response, which is certainly impressive. But the more text that's pulled in, the more intensive and complex the computation, leading to potential errors. And a novel has myriad names, places, character arcs and plot points, alongside the changes that are essential to a good story. "These language models, they're just not up to that level of complexity," France said.

What's more, they write variations on what's already been written. "We don't just want novels to feel like every other novel that's ever been written," she added.

France says that if you did want to write a novel using the limited AI systems of today, they can be helpful tools, helping to brainstorm or conquer writer's block by dumping something onto the page. "They can be interesting tools, but they're not going to replace human creativity any time soon."

In short, it's certainly possible to ask an LLM to write a novel in one go, but it'll come out terribly – dull, repetitive and nonsensical. Call it a new experimental style all you'd like, but it will be gibberish. Using AI as a limited tool while acknowledging its downsides may prove more fruitful.

You'll have to do so in chunks, perhaps plotting out your own story and creating your characters, while asking GPT or LLaMA to spit out the words. APC asked the Bing AI tool, which uses GPT-4, to write a short analysis of this topic, a pair of AI-themed jokes, and short stories in the style of Atwood and King; they were consistently terrible.

So AI could help write a story, but the would-be novelist still needs to supply the idea, develop the story and characters, and then edit the subsequent text spat out by the LLM. It sounds a lot like doing most of the work to get a substandard result.

End the guesswork

Authors shouldn't have to rely on guesswork to know if their copyright has been infringed. And if we're going to trust these LLMs with our businesses, creativity and the rest, we need to know how the sausage is made. These systems can't be black boxes fed by unknown sources. The CEOs at Meta, OpenAI and Google have warned about the existential risk of AI, yet won't share their recipes or ingredients so others can spot such dangers.

Regulators are considering action, while experts at the Turing Institute, where France works, are calling for academic openness in AI development. What would help authors? "Taking [legal] action against AI developers is one approach, but it is just as important – if not more important – to engage with industry and government about this issue, and to ensure that our members' interests are at the forefront of decisions that they make about future policy and practice," said SoA's Solomon.

"Many SoA members are concerned about the impact of generative technologies – many of them unhappy that their work is being used without permission, but with an increasing number raising concerns about the direct impact AI is already having on their ability to earn a living," she added. "It might be a while before an LLM can generate a publishable literary novel without human editing, but AI is already being used commercially to produce illustrations and photorealistic images, translations and journalism, in ways that push aside and devalue human input."

In the meantime, "novelist" may be one job that remains despite the threat of AI. Because so far, it's even worse than most of us at writing a great book. ■

Novel experience The writers' view

Not all those who are au fait with the finer details of AI can appreciate creative work. And not all novelists understand the inner workings of an LLM. Handily, APC has two alumni who have left technology journalism for successful careers as award-winning novelists. We asked Stuart Turton and Thomas McMullan for their thoughts on the AI versus writer war.

THOMAS MCMULLAN

Author of *The Last Good Man* (winner of the Betty Trask Prize)

There is an urgent need for regulation on this. Copyright should be able to protect writers and their labour, forcing developers to disclose exactly what works they have used to train these models, and if there is any infringement of copyrighted material that needs to result in legal consequences. There should be automatic opt-out for published works, with the onus on consent and remuneration of authors whose works are being used. I don't care if it slows down how quickly these systems can learn to write. They don't learn how to write, they learn how to parrot. On a moral level, the soulless s*** that these AI systems regurgitate is damaging not just for writers and artists but for how we think about the world in general, turning the act of human expression into a funhouse of mirrors, constantly reflecting distorted versions of the past back to us.

STUART TURTON

Author of *The Seven Deaths of Evelyn Hardcastle*, *The Devil and the Dark Water* and next year's *The Murder at the End of the World*. He's won the Costa First Novel award and Books are My Bag Readers award.

Sigh. Shrug. F*** me. That's how I feel about all of this. Am I bothered by AI one day churning out Stu Turton clone books? Yup, but I'm more bothered by the ever-shrinking advances that increasingly make this job a hobby for the rich. I'm bothered by celebrity authors who automatically get a publisher's entire marketing budget even though their face is marketing enough. I'm bothered by the dwindling numbers of readers, and the knowledge that my career could be sunk by one bad book. AI's the shark in the distance. It's really scary, but the likelihood is that I'll have been eaten by piranhas long before it gets anywhere near me.

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The A-List

The best products on the market, as picked by our editors.

Premium laptops

Apple MacBook Pro 16in (M2)

STUNNING CREATIVE POWER

All the upgrades to this 2023 model are within, as Apple's M2 Pro and M2 Max processors take charge. Combine this power with the 16.2in mini-LED screen, superb sound system and phenomenal battery life, and you have the world's premier workstation laptop. **From $3,199, apple.com/au**

THE ALTERNATIVES

ASUS VIVOBOOK PRO 16X OLED
This 2023 update has some impressive features for the price and is a surprisingly powerful creative workstation with a stunning screen.
$3,199, asus.com

APPLE MACBOOK AIR
The MacBook Air M2 looks like a standout to us. A powerful and quiet ultraportable with an unbeatable battery life and a great pro display.
From $1,799
apple.com/au

MICROSOFT SURFACE PRO 9
APC rates the Intel model highly, the SQ3 model less so. With Intel, you get a solid upgrade to the world's leading detachable tablet laptop.
$1,547
microsoft.com

Business laptops

NEW Lenovo ThinkPad X1 Carbon Gen 11

BUSINESS CLASS

Fight past Lenovo's opaque pricing – another flash sale, really? – and you'll find a slim, powerful and long-lasting laptop for a competitive price. With a wide range of available configurations, all based on Intel's 13th generation Core chips, this is our top choice for all sizes of business. **From $2,086, lenovo.com**

THE ALTERNATIVES

NEW DELL LATITUDE 7340
This 1.1kg laptop offers terrific battery life and, if you choose the better non-touchscreen (look for 400 nits of brightness in the specs).
$2,475
lenovo.com/au

ACER TRAVELMATE P6
Not the most powerful due its 11th gen Core chip, but a great 14in screen and keyboard, superb battery life and competitive price lift it above rivals.
$2,179
acer.com

NEW ASUS EXPERTBOOK B1 B1502
With a Core i7-1255U, 16GB of RAM and 1TB SSD, this 1.7kg laptop packs in lots of power, albeit with a so-so 15.6in screen.
$1,499, asus.com

Gaming laptops

Razer Blade 15 (2022)

A SUPERBLY ENGINEERED GAMING POWERHOUSE

Right now there's just not another better value gaming unit around. It's miraculously thin considering the beefy components inside, thermals are very well managed and the Razer Blade 15 manages to extract very good performance from its GPU without undue throttling. There are many variants and options, and they're an outstanding buy if you find one on sale. **~$2,999, razer.com/au-en**

THE ALTERNATIVES

LENOVO LEGION 5I PRO (16IN)
A great-value gaming laptop that's extracts the most from its powerful components. We really love the keyboard, too.
$3,899
lenovo.com/au

RAZER BLADE 18
A great advert for 18in gaming laptops, the Blade 18 partners a Core i9-13950HX with RTX 40-series graphics in a stunning, slim design.
$5,399,
razer.com/au-en

ASUS ROG STRIX SCAR 18
It's expensive, but if you want an 18in laptop that delivers all-out power this is the no-compromise 3.1kg beast to buy – it packs quality everywhere.
From $4,599
asus.com/au

Everyday laptops

Asus Zenbook S 13 OLED

ASUS AND INTEL TEAMED UP TO BUILD A MACBOOK AIR KILLER

A compact and budget friendly Ultrabook that's the best available device for many on-the-go professionals. Compared to the MacBook Air 13, it has an additional HDMI and USB-A port, an SSD that's roughly twice as fast, and the screen is brighter and offers rich OLED contrast. **$2,099, au.store.asus.com**

THE ALTERNATIVES

MICROSOFT SURFACE LAPTOP GO 2
Runs cool and quiet, and has up to 30 percent better battery life than its predeccessor, all in a beautifully designed form. From $1,199,
microsoft.com

APPLE MACBOOK AIR 15
An awesome plus-size MacBook Air with great battery life and graphical performance. GPU performance and battery life are the standout perks here. From $2,199,
apple.com/au

HP PAVILION 14
This slim 1.4kg laptop is a superb choice for anyone on a tighter budget. it struck an excellent balance between speed and battery life – around ten hours. From $949,
store.hp.com

Chromebooks

Asus Chromebook Flip CX5

The best big-screen Chromebook we've tried, with a bright 15.6in Full HD display with decent black levels and surprisingly rich colours. And it's a good specification for the price, with a Core i5 processor, 8GB of RAM and a 256GB SSD in tow. **$1,179, asus.com/au**

Lenovo Flex 3i Chromebook

This isn't the most powerful Chromebook, but students need reliability more than power – especially if they're only really using it for homework, note-taking, and perhaps the occasional bit of Netflix.
$367, lenovo.com/au

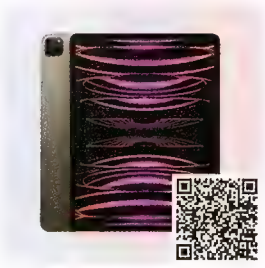
Lenovo IdeaPad Duet

The Chromebook answer to Microsoft's Surface tablets, this is a seriously versatile device – albeit not the speediest (although we never found it to be painfully slow while carrying out everyday tasks). For this price, and with a 16hrs 14mins battery life, the Duet is a great choice.
$297, lenovo.com/au

Tablets

Apple iPad Pro 12.9in

Blurring the boundaries between laptop and tablet like never before, the M2-powered iPad Pro 12.9-inch is every bit as fast as we expected – and the Liquid Retina XDR display is simply phenomenal.
From $1,899, apple.com/au



Google Pixel Tablet

A powerful and vibrant tablet that works seamlessly as a Google Home Hub. Google's first local tablet is an awesome addition to your smart home, and its lower price point doesn't hold it back from competing with the best.
From $899, store.googlecom/au

Samsung Galaxy Tab S9 Ultra

This 14.5in tablet offers a size and versatility that even the iPad Pro can't match, with its high price more than justified by the quality of Samsung's AMOLED panel, speakers and productivity software.
$1,999, samsung.com

Everyday monitors

MSI MEG 342C QD-OLED

Quantum Dot technology combines with an OLED self-emitting panel to offer brighter, more efficient and more colourful visuals than your average OLED screen.
$1,799, msi.com

Eizo FlexScan EV2480

Businesses in particular will love this easy-to-roll-out 24-inch monitor, with its exceptional five-year warranty, USB-C port for easy docking, excellent viewing angles and delicious whites. And it has the best OSD around.
$619, eizoglobal.com

Dell S2721DS

The Dell S2721DS is a solid and affordable QHD monitor that'll suit general users and casual gamers alike. It boasts a gorgeous 27-inch 1440p display, a 75Hz refresh rate, and a vivid IPS panel that hits 99 percent of the sRGB color gamut.
$319, dell.com.au

Professional monitors

Eizo ColorEdge CG319X

As the price indicates, this monitor is for heavyweight creatives who demand the best in every discipline: HDR video editing, print layouts, professional photography and more besides. With superb coverage and accuracy across all spaces, plus a built-in calibrator, it justifies the investment.
$5,995, eizoglobal.com

BenQ PD2725U

By no means a cheap 4K 27-inch monitor – unless you compare it to the Eizo – but it marries all-round quality with ease of use thanks to a puck that allows you to quickly move between settings. You can even daisy chain a second Thunderbolt 3 monitor for a monster setup.
$1,399, benq.com

Asus ProArt PA279CRV

Asus's new 4K productivity panel delivers near pro-levels of performance and precision, though its HDR capability is inevitably limited. What you get is Asus's usual high levels of build quality, plus extras, including essential HDR support and a stand that includes rotation into portrait mode. $799, **asus.com**

Home office printers

Epson EcoTank ET-1810

There's nothing flashy about this bottle- fed inkjet: it's there to churn out pages at a decent rate (8.8ppm for black text) for a low price. It comes with enough ink for 4,500 black pages and 7,500 in colour, but refills are cheap. Just don't expect features like duplex printing.
$249, epson.com.au

Canon Pixma Pro-200

Yes, it's big and it's expensive – and you don't even get a scanner – but the Pixma Pro-200 means that you can print A3 photos with glorious colour accuracy and detail. If you're after an office workhorse, look elsewhere, but it can't be beaten on photo quality.
$719, canon.com

Brother MFC-J4540DW

Home workers will love this inkjet all-in-one. It combines an incredible range of features with all the connectivity you need and extreme ease of use. Output quality is fine, it offers the best cloud support around and the high-capacity ink pack could keep you going for years.
$329, brother.com

Wireless routers

Synology WRX560
Its quad-band Wi-Fi smashed-through our performance tests managing 791.5Mbps up close, 375Mbps two rooms away and an amazing 216.7Mbps down the garden.
$419, synology.com/au

Asus ROG Rapture GT-AX16000
The most splendid, overpowered router on the market. But, it's silly money and aspirational to most users. Ultimately, though, it's currently the highest-spec consumer router available.
$999, asus.com/au

Asus TUF Gaming TUF-AX4200
Ultimately, this is one of the very best featured and fastest routers we've ever tested and, at $320, it's a steal. It's affordable, fast and dripping with features. Only power users might want more performance headroom.
$319, asus.com/au

Mesh Wi-fi

TP-Link Deco XE200
There are cheaper Wi-Fi 6E meshes, but the XE200 wins for its superb download speeds, excellent coverage and the fact that older clients reap benefits of 6E, not just new ones. And a two-pack should be enough for most premises.
$1,299 (2-pack), tp-ink.com

TP-Link Deco X20
The Deco X20 makes it possible to upgrade your home network to Wi-Fi 6 for the price of some standalone routers. The HomeCare functions are also a great bonus for households where lots of devices are fighting over the bandwidth. **$227 (2-pack), tp-link.com**

Asus ZenWiFi AX
The interface and design certainly aren't the prettiest (the charcoal version is straight out of the 1980s), but if you're after strong performance, great features and plenty of expansion potential, the ZenWiFi AX is a compelling prospect.
$939 (2-pack), asus.com/au

NAS servers

QNAP TS-130
An above average CPU and RAM combo, solid features and affordable price make the QNAP TS-130 worth considering. Alternatively there's the two bay TS230 which features the same CPU, with 2GB of RAM, dual drive bays, and an extra USB port on the front for a modest ~$50 price increase. **$199, qnap.com**

Asustor Nimbustor AS5304T
This is a hugely powerful four-bay NAS that will be overkill for most people – not just due to its speed but also its slightly intimidating user interface – but techies and gamers should investigate the Nimbustor AS5304T for both its speed and flexibility.**$679, asustor.com**

Synology DiskStation DS1522+
At $1,199 it's not cheap but factoring in the software means it's great value. Though some internal silicon may lack headroom, this is still a well-featured, expandable NAS with fantastic software. The best part is the DSM software.
$1,199, synology.com

Security software

G Data Total Security
A suite for power users with a host of useful features that offers formidable protection against viruses.
US$49.95, 1 device, gdatasoftware.com

THE ALTERNATIVES

AVAST ONE ESSENTIAL
The only product in our tests to score a 100% protection rating for blocking all malicious files, this reliable choice is our pick of the free AV tools and includes a free if limited VPN service.
Free, avast.com

MCAFEE+ ADVANCED
A high-end choice with high-end features and support for an unlimited number of devices. Good value for the first year, but watch out for renewals.
$139.95, individual, unlimited devices, mcafee.com/en-au

NordVPN
NordVPN provides consistent and fast speeds, serious security, great support for video-streaming services and some cost-effective subscription rates.
$59 per year, nordvpn.com

THE ALTERNATIVES

PROTONVPN
ProtonVPN provided one of the best free offerings of all the VPNs in our group test, including unlimited data, but upgrade to benefit from even faster speeds and many more options.
Free, protonvpn.com

SURFSHARK
A strong rival to NordVPN, especially if you're willing to commit to its two-year contract. It's fast, cheap and a fine choice for people who like to switch to US streaming services.
$79.61 for one year, surfshark.com

Bitwarden
Bitwarden has a huge advantage: it's free. It isn't as slick as some paid-for rivals, but it can sync passwords across all devices for no extra charge. **Free, bitwarden.com**

THE ALTERNATIVES

DASHLANE
A manager that's ideal for beginners, and it even builds in an unlimited (if basic) VPN service. Note you may prefer to buy the Family plan ($60 per year) as this extends the service to six people.
$55.99 per year (Premium), dashlane.com

1PASSWORD
1Password is targeted at users who are looking for the last word in security. It even offers a Travel Mode that may ease your mind if surrendering your phone to customs officials. **$54.99 per year (individual), 1password.com**

NEW POWER

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Pure Power 12 M is be quiet!'s entry in the ATX 3.0 era. The Pure Power 12 M is ATX 3.0 compliant, PCIe 5.0 compatible and offers peerless dependability with best-in-class features. Having both a PCIe 5.0 12VHPWR cable and up to 4 PCIe 6+2 cables in the scope of delivery, this PSU offers outstanding compatibility with current-gen and next-gen graphics cards. Pure Power 12 M offers the best combination of features in its class. It is available with: 1000W, 850W, 750W, 650W and 550W.

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VirtualBox *vs* VMware Workstation Player

Nick Peers asks what's best for running virtual machines for free?

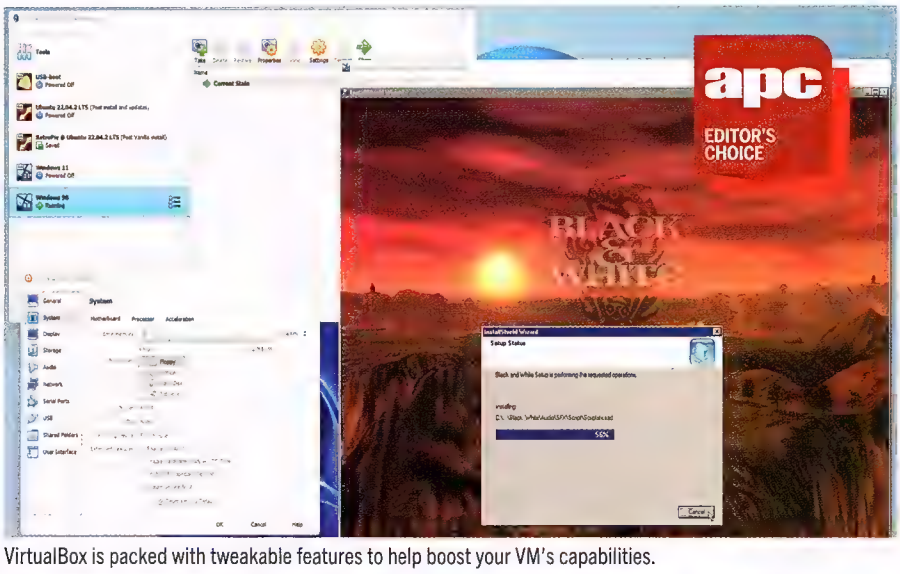
Whether you're looking to recreate an older version of Windows to play classic games or try different flavours of Linux without having to set up a dual-boot system, virtualisation is the answer to your prayers. The good news is that it costs nothing to emulate OSes on your PC thanks to these two options, both of which are free for personal use. But which one is better? We put both to the test to find out.

Superficially, both VirtualBox and VMware Workstation Player do the same thing, but there's plenty of differences to mark them distinct from each other. If we start with VirtualBox, it's free to use, and mostly open-source, so there are no restrictions in play unless you need access to fast USB peripherals, in which case a non-commercial restriction applies. In contrast, the free version of VMware is restricted to personal use only, while it also strips out some key functionality for those who don't want to pay for a commercial license. More on those shortly.

Both VirtualBox and VMware can emulate a wide range of Windows and Linux OSes – 32-bit as well as 64-bit. They can both technically run macOS in certain circumstances too, but it's completely unsupported, and the steps can be tortuous to follow.

Installation of both tools is straightforward, although VMware does ask some slightly opaque questions during installation – what, for example, is the benefit of the Enhanced Keyboard Driver (that forces a system reboot if installed)? Answer: none, in most cases.

Your emulated machines store their data in special files that mimic virtual hard drives – VMware is exclusively tied to its own VMDK format, while VirtualBox can work with VMDK and VHD (Microsoft) formats, as well as its own native VDI format. This means you can technically attach VirtualBox to hard drives created in VMware, making switching simple.



VirtualBox is packed with tweakable features to help boost your VM's capabilities.

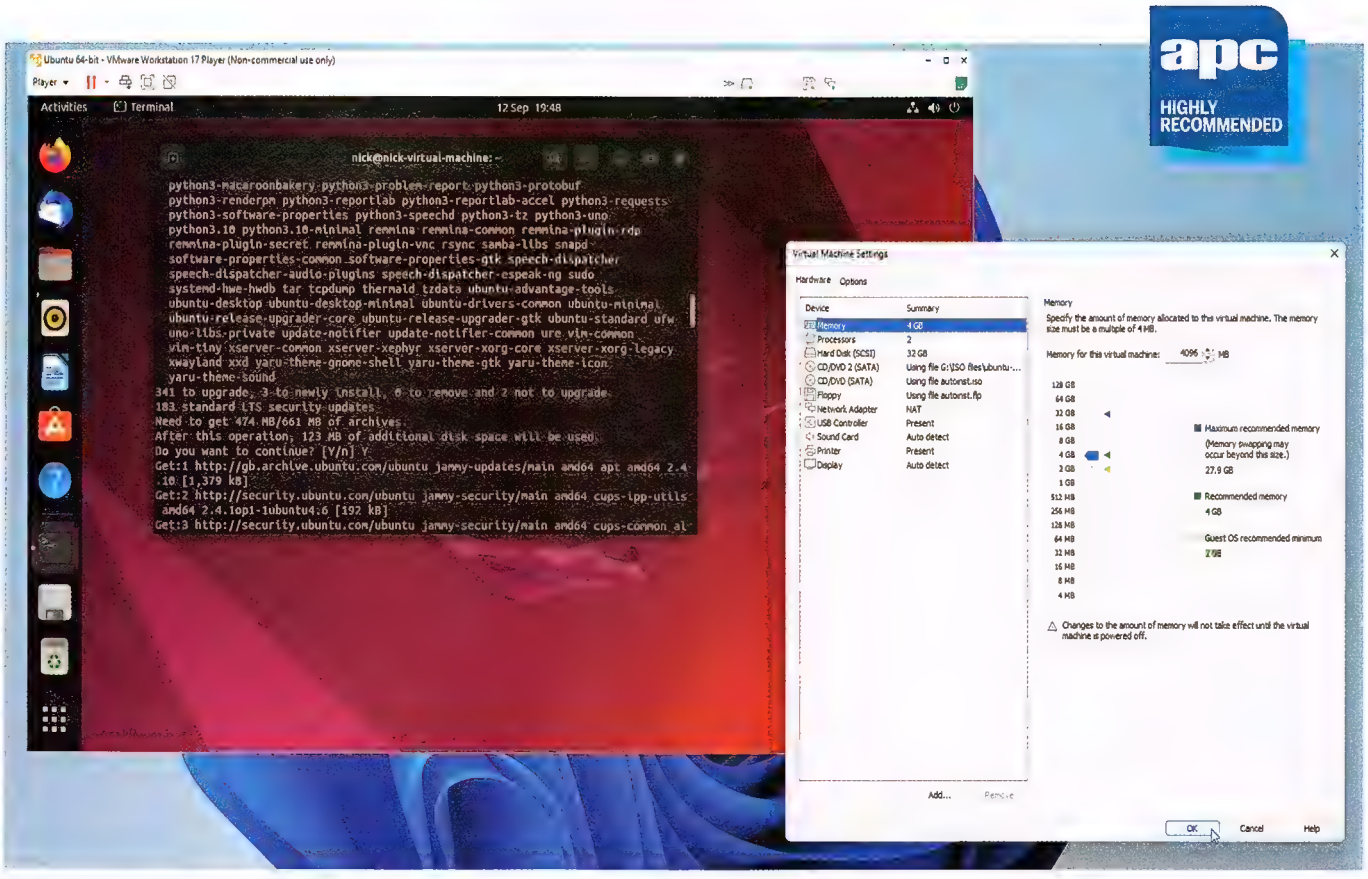
"Superficially, both VirtualBox and VMware Workstation Player do the same thing, but there's plenty of differences to mark them distinct from each other."

Installing your virtual OS is a similar procedure: create a VM (virtual machine), attach your chosen OS install media, then tweak various hardware settings to improve performance without taking too much away from your underlying PC. The VM then runs in its own window, inside which you install your chosen OS as if you were installing it on a separate PC.

Both VMware and VirtualBox attempt to simplify this process with an 'Easy Install' (VMware) or 'unattended installation' (VirtualBox) feature on supported OSes. In theory, you simply supply additional information, such as your choice of username and password, that the VM tool then inserts during the install process.

It's not foolproof – you're limited to local user accounts in Windows, while both tools proved problematic with Ubuntu. VMware's Easy Install failed to do anything, while VirtualBox's solution fails to add your user account to the all-important sudo users group, which forces you to apply a fiddly fix.

Once installation is complete, you'll find yourself at your chosen desktop with all basic drivers installed. As things stand, however, you need additional drivers and tools to unlock the full potential of your VM – support for 3D graphics and a full range of desktop resolutions, for example, or the ability to share keyboard, mouse, and data between VM and host with ease. Neither tool offers this as part of their easy install routine, but they're equally accessible (choose 'Player > Manage > Install VMware Tools' or 'Devices >



VMware isn't as configurable as VirtualBox, but it's the clear winner in 3D performance.

Insert Guest Additions CD Image' respectively).

Comparing performance

In everyday use, both products offer similar performance. Obviously, your host's underlying hardware, from your processor and RAM to hard drive type and speed, all play a key role – and if you have the processor cores and RAM to spare, you'll want to allocate as much as possible to make a noticeable difference to the speed of your VMs; nevertheless, they'll (understandably) always lag behind the equivalently specc'd native hardware.

Benchmarks reveal that VMware has a small edge over VirtualBox in processor and RAM scores on comparable setups, but it does offer improvements when it comes to graphics performance, particularly in 3D. This is down to several factors: first, VMware can allocate more RAM to your virtual GPU – up to 8GB versus VirtualBox's paltry 256MB (which reduces to 128MB when 3D acceleration isn't enabled). VMware also supports newer technologies – DirectX 11 and OpenGL 3.3 versus VirtualBox's somewhat creaking Direct3D 9 and OpenGL 3.0 – which also opens access to a wider range of games.

It's fair to say you wouldn't be running the latest cutting-edge games in either virtual machine, but if you're looking for some nostalgic gameplay with 3D-heavy titles that don't run in Windows 11, VMware is likely to deliver better results.

> "your choice will be driven by your needs – if it's gaming (and 3D gaming, at that), then it doesn't matter how limited VMware is; its performance edge means it'll win the day."

In non-gaming use, however, there's less to call between them, although VMware does at least boast native support for USB 3.1 (VirtualBox's free extension pack limits you to USB 3.0). Elsewhere, however, you're likely to find VirtualBox's flexibility and lack of restrictions make it the more compelling choice.

For example, VirtualBox allows you to create multiple snapshots of your machine, so you can roll back the changes and use your VM as a test bed; snapshots aren't supported in the free version of VMware, which is especially disappointing when you discover them in the free version of VMware Fusion, the macOS equivalent. VirtualBox is also more configurable, with a wider range of choices when configuring VMs – including hardware tweaks that can claw back some of the performance deficit – compared to VMware.

Ultimately though, your choice will be driven by your needs – if it's gaming (and 3D gaming, at that), then it doesn't matter how limited VMware is; its performance edge means it'll win the day. For all other needs, however, you're likely to err towards VirtualBox's greater set of features, open-source ethos, and lack of restrictions. But since you can install both side-by-side, why not enjoy the best of all worlds and use both? ■

VERDICT

★★★★½

VirtualBox Very clear and loud with great battery life, it's decent value though with potentially less range.

★★★★

VMware Workstation Player Superior performance on DirectX 11-compatible games, Pop-up hints and tips. Key features missing from the free version; Less configurable than VirtualBox.

GADGETS

The gear we're lusting after

Marshall Motif ANC II

$349 | marshallheadphones.com

Audio gear maker Marshall isn't afraid to wear its rock heritage on its sleeve and with portable speakers like the spectacular Middleton, that's very good news indeed. Now it's updated its Motif active-noise cancelling (ANC) earbuds with improved connectivity, thanks to Bluetooth LE. Plus, they now offer longer battery life, lasting for up to 30 hours with ANC on when used with the charging case – that's 10 hours more than before – or up to six hours solo. They also deliver up to one hour of playback time on a 15-minute charge.

Eschewing Apple's all-white AirPods aeshetic in favour of rockstar black with white and gold highlights, the Motif ANC II earbuds and charging case are nonetheless made from 70% post-consumer recycled plastic, fashioned from plastic bottles, car headlamps and, rather pleasingly, old electronics. Cool.

The Motif ANC II earbuds blend rockstar styling with environmentally conscious credentials.

Ruark R410

$2,599 | ruarkaudio.com

The Ruark R410 is the kind of hi-fi you'd expect *The Good Life*'s Margo Leadbetter to have at home. Available in soft grey and walnut or walnut and, erm, walnut, it screams 70s dinner party, but inside it's very high tech indeed.

That's because as well as boasting a 120W Class D amplifier and integrated speakers, it also features a DAB/DAB+/FM radio, Bluetooth 5.1 and Wi-Fi 6, plus support for streaming music services including Spotify and Tidal.

Best of all, it comes with AirPlay 2, enabling you send sounds to it from your iPhone, iPad or Mac. Plus, it also includes multi-room audio support, so you can integrate it into a whole-home sound system. Margo would be pleased.

THINKVISION 27IN 3D MONITOR

$TBC | lenovo.com

Just when you thought it was safe to return to the office, Lenovo has come up with this: a glasses-free 2D/3D monitor. Aimed at creative pros that specialise in 3D visualisation, 3D video and 3D video games rather than Dave from accounts, it includes a lenticular lens switching system as well as clever eye-tracking tech. The 27-inch 4K (3840x2160) display also delivers 99% colour accuracy with Adobe RGB and DCI-P3 wide colour – making it ideal for home users too. It even has a USB-C dock with Power Delivery and stereo speakers.

NOMAD BASEONE MAX 3-IN-1

$TBC | nomadgoods.com

Nomad's BaseOne Max has always been one of the best iPhone charging stands around – and this new version should even better. That's because this second-gen model now comes with a Qi wireless charging pad for your AirPods as well as for your iPhone and Apple Watch. Available in Silver or Carbide, it's premium metal-and-glass design puts lesser stands in the shade. It also delivers up to 15W of MagSafe charging power to your iPhone – the maximum allowed by Apple.

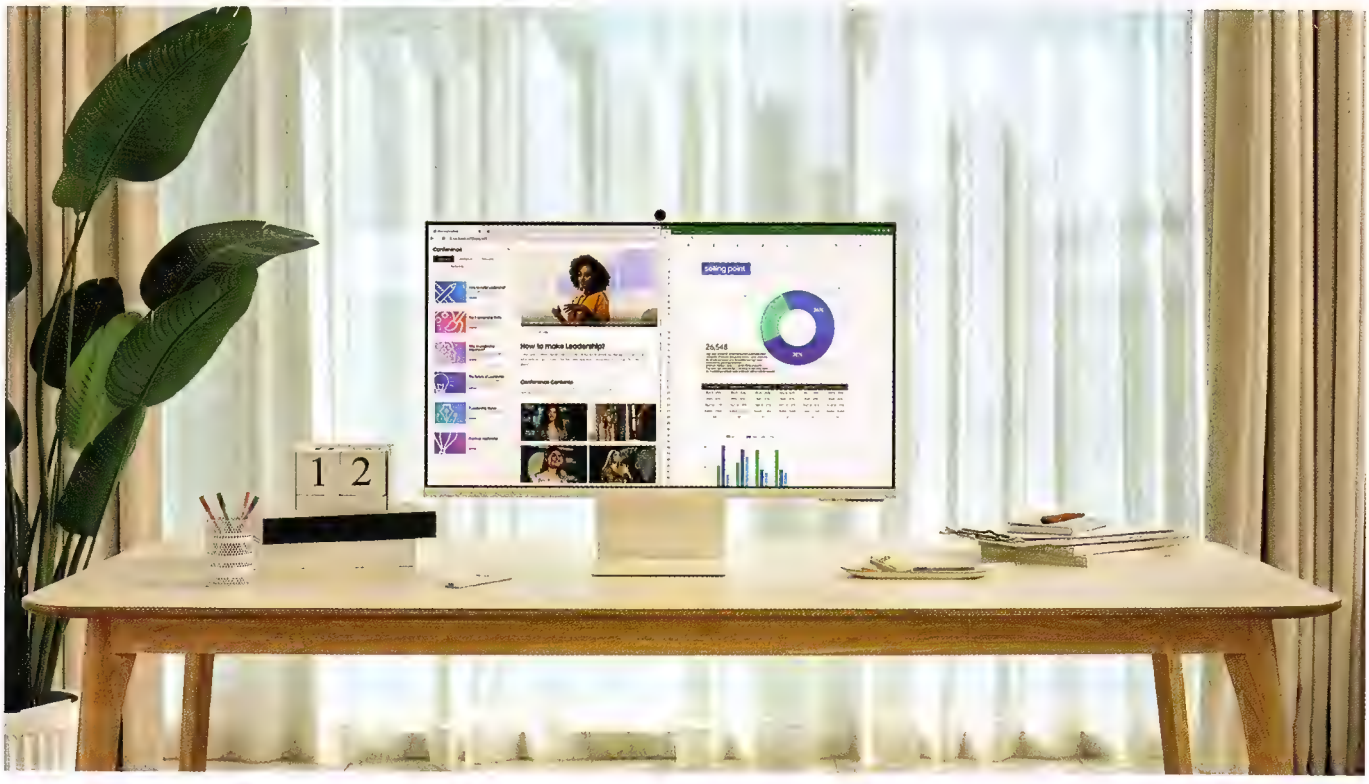
SWITCHBOT S10 THINKVISION

$TBC | witch-bot.com

LiDAR enables your iPhone Pro to do all kinds of clever things – but none can possibly measure up to the one offered by this groovy little sucker. To put it simply, the S10 is a robotic floor cleaner that uses LiDAR to analyse the world around it, hunting down dirt, dust and pet hair as well as spills – yes, the S10 can also wash and dry your floors too. Heck, it can even refill a humidifer if you need it to. Capable of behaving almost completely autonomously, the only thing you need to do with the SwitchBot S10 is empty its dust bag every 70 days. Now that's smart!

REVIEWS

Expert reviews and recommendations to help you buy with confidence



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APC is Australia's oldest consumer technology magazine – having been consistently in print for over forty years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech, too, from smartphones and apps to peripherals, accessories, and beyond. We have two goals: to find the best modern tech and to help you make the most of it.

Independent reviews

Championing technology doesn't mean we're unrelenting yes-men and -women, however, and APC aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three attributes.

As a matter of policy, reviews published in APC are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an APC reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

Labs testing

APC strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance including storage read and write speeds, gaming and battery life.

APC TESTBED THE CURRENT APC TESTBED USED IN THE LABS FOR BENCHMARKING ALL COMPONENTS. THIS TESTBED IS UPDATED AS NEW AND RELEVANT TECHNOLOGY COMES ON STREAM.

CPU Intel Core i9 12900K **Motherboard** Asus Maximus Z690 Apex **Graphics Card** Nvidia GeForce RTX 4090 Founders Edition **RAM** 2x16GB G.Skill Trident Z5 DDR5-6000 **Power Supply** Corsair AX1000 **Storage** Seagate Firecuda 530 2TB **Case** Thermaltake Core P8 **Cooling** Cooler Master Flux PL360 AIO **Operating system** Windows 11 Pro 22H2

APC EDITOR'S CHOICE
When a product scores 4.5 out of 5, it carries the Editor's Choice Award. These are products that exceed expectations and deliver a quality experience up there with the very best.

APC HIGHLY RECOMMENDED
You will see this award if a reviewed product has scored four out of five stars. It means most people can expect satisfying performance from the product, and that we would use it ourselves.

PRICE $3,499 **WEB** hp.com/au-en

HP Spectre X360

HP's new premium 2-in-1 is sporting an Intel Arc GPU, but is it powerful enough to haunt creatives into buying one.

It's been a couple of years since we last looked at a Spectre X360 from HP, but the 2023 model is one of the first laptops we've seen with a discrete Intel Arc graphics card, a feature that made it definitely worth looking at. Apart from this high profile inclusion, the 2023 Spectre X360 2-in-1 has a number of other standout features that make it a genuinely intriguing device.

Most prominent of these is the 16-inch multi-touch OLED display that has a 3072 by 1920 pixel resolution and is bright enough to offer striking visuals. It's also a highly capable creative professional device since the screen offers full DCI-P3 colour reproduction that pairs with the above-average GPU processing power to make a solid device for more demanding graphical tasks.

While the GPU is interesting, we wouldn't get too carried away with performance expectations. The Intel Arc 370M featured on the Spectre X360 offers 80% performance improvements over the Intel Iris Xe integrated graphics, which is around half the performance offered by Nvidia's entry level RTX 4050 GPU and between 20 and 25% behind earlier RTX 3050 and 3050 Ti dedicated graphics cards. Enough to mean it can play games like *RDR2* and *Cyberpunk 2077* at around 30 frames per second using 1080p Low settings and you'll get closer to 60fps for less demanding titles. The Arc 370M adds enough performance over integrated graphics to be worthwhile, but if they're the same price, you'd still opt for a Nvidia Geforce RTX 3050.

BENCHMARK RESULTS

	HP Spectre X360 2-in-1 16-f2010tx	Lenovo Slim 7 Pro X (14" AMD)
PCMark 10 - Overall (score)	5,819	6,377
Geekbench 5 - Multi-core (score)	5,660	8,801
Cinebench R23 - CPU (multi-threaded)	6,199	12,114
3DMark - Time Spy (score)	3,416	4,190
Sid Meier's: Civ VI - 1080p Ultra (fps av.)	45	76
Battery life - 1080p video playback (h:min)	5h17min	11h07min
CrystalDiskMark Read (MB/s)	6,728	7,061
CrystalDiskMark Write (MB/s)	4,874	5,020

SPECS W 11 Home; 16-inch OLED display at 3072 by 1920 pixel resolution, multi-touch, 500nit, DCI-P3; Intel Core i7-1360P CPU; Intel Arc 370M 4GB (30W); 16GB RAM; 512GB PCIe SSD; 79Wh battery (5h17min 1080p movie playback); 35.8 x 24.5 x 1.99cm; 2.15kg.

Powering the rest of the performance here is an Intel Core i7-1360P CPU which is Intel's mid-powered i7 laptop offering in the 13th generation range. The 28W 12-core 16-thread processor offers more than enough power for your average workload... but it's not quite as powerful as what you'll get in a gaming laptop or workstation. This is probably a good choice for this device considering the added discrete graphics already draws enough power to mean you'll only get around six hours and 48 minutes in light work tasks and five hours and 17 minutes in 1080p movie playback. It's not ideal for a device pitched at workers who really need a full work day of battery life, but it's got enough battery for those that are fine to carry a charger.

HP has been working on software recently and the applications that come to help optimise the Spectre X360 are actually pretty decent. For those that do a lot of online meetings there's the HP enhanced lighting app that brightens your screen to cast your face in a better light for the webcam and a HP PC Diagnostics tool that makes it easier to check for device-specific updates and detect any system issues.

We do wish HP bundled in a stylus to use with the multi-touch screen, seeing as this is presumably one of the main reasons someone would want to buy this particular device, but it does come with a folio cover which will come in handy for many. With a better screen than the LG Gram 2-in-1 16 and at a lower cost than the Microsoft Surface Laptop Studio this is arguably one of the top 2-in-1s on the market.

VERDICT

★★★★

A fairly priced 2-in-1 with a great screen and step-up graphics capabilities.

Joel Burgess

PRICE $3,199 **WEB** hp.com/au-en

HP Victus 16 (2023)

HP's latest mid-range gaming laptop ticks all the boxes, but does it stack up to be something you'd want to game on?

Like its predecessor (which we covered in APC 523) the 2023 HP Victus 16 is a 16-inch performance first gaming laptop at a price that many will be able to consider. It's not exactly a gaming ultrabook with a weight of 2.3kg, but it's light enough to be fine to carry with you when you really need to. And it's black metal chassis makes it a good fit for both work and play.

The Victus 16 we looked at came with an Intel Core i7-13700HX CPU, a Nvidia GeForce RTX 4060 GPU and a generous 32GB RAM allocation to complement an entry gaming 1080p display with a 144Hz refresh rate. At the time of writing the device tested here was still on pre-sale at Harvey Norman for $3,199 (the only outlet for this particular model). Unfortunately, this makes the Full HD Victus 16 expensive against the wide array of devices already on the market.

You can get an MSI Stealth 16 Studio gaming Ultrabook with similar specs and a 240Hz QHD+ display for $2,699 on sale, for example, or an Asus ROG Strix G17 with an equivalent Ryzen 9 CPU and bigger WQHD 240Hz screen for $100 less at full price (or $500 less than the Victus 16, on sale).

SPECS W11 Home; 16.1-inch IPS display at 1920 x 1080 pixel resolution, 144Hz, 250nit, 45% NTSC; Intel Core i7-13-700HX CPU; Nvidia GeForce RTX 4060 GPU; 32GB RAM; 66.5Wh battery (5h37min 1080p movie playback); 36.9 x 25.9 x 2.3cm; 2.31kg.

> "It's one of the least effective displays you could fit on a gaming laptop."

To add salt to that wound, the 144Hz Full HD screen only offers 250 nit brightness and is only capable of producing just over half of the sRGB colour gamut... so it's one of the least effective displays you could fit on a gaming laptop. It's fine for basic gaming, but it doesn't look great in bright environments and won't look good for media and work applications that require a vibrant display.

It's also not exactly the highest performing rig doing the rounds. Against an Acer Predator Helios Neo 16 with the same CPU, GPU and less RAM that we looked at back in APC 522, the Victus 16 was on average around 5% behind in gaming and graphics tasks. The extra RAM on the Victus did mean it was able to achieve higher performance in some general work tasks, but this wasn't across the board.

The Victus 16 did offer an above-average battery lifespan against comparable gaming laptops, but that still only equates to four hours and 22 minutes for light work tasks and five hours and 37 minutes in 1080p movie playback.

The device offers PCIe storage that runs at 6,949MB/s read and 4,873MB/s write and you'll get all the latest wireless connectivity options and a good selection of physical interface options, so it's not like this unit has any unsalvageable flaws, but it isn't competitively priced and the screen is the worst we've seen on a gaming laptop at this level.

BENCHMARK RESULTS	HP Victus 16 (2023)	Acer Predator Helios Neo 16
PCMark 10 - Overall (score)	6,890	7,286
Geekbench 5 - Multi-core (score)	15,250	12,296
Cinebench R23 - CPU (multi-threaded)	19,366	21,375
3DMark - Time Spy (score)	10,369	10,811
Cyberpunk 2077 - 1080p Ultra (fps)	86.84	94.86
Battery life - 1080p video playback (h:min)	5h37min	5h19min
CrystalDiskMark Read (MB/s)	6,949	7,156
CrystalDiskMark Write (MB/s)	4,873	5,028

VERDICT

★★½

A mid-range gaming laptop with a high price and poor screen.

Joel Burgess

PRICE $169 **WEB** www.asus.com/au

Asus RT-AX1800S

Asus' has shown us plenty of amazing, pricey routers, but how good is this cheap one?

We've seen many high performance routers lately, so we're pleased to see a budget model in our Labs. Most models have come from Asus, but they've all been under the ROG and TUF gaming brands. The RT-AX1800S is a straight-up Asus Wi-Fi router and is in the stores for just $139. In sales, it can already be found for under $100. It uses the same Asus app that we've seen in dearer models but what are the limitations and is it worth buying?

The first thing we noticed was its build quality. Budget routers often look and feel like cheap tech which you wouldn't want in your home, but Asus' glossy, textured chassis is impressive.

Set-up is simple via the well-polished Asus app. We did raise an eyebrow at not being able to combine the two channels into one – the RT-AX1800S has an individual 2.4GHz network and a separate 5GHz network.

Unsurprisingly, there are fewer features available within the app compared to its dearer, gaming-focused siblings but what's left is still impressive. The first two screens provide useful and intuitive visualisations of your network's status and the devices connected to it. You can also easily block access, limit bandwidth and bind each device to an IP.

The third tab offers insights into your network and reminds you to update the firmware and activate any security features you might have missed. The latter includes Asus' Trend Micro-powered "Aiprotection" technology which scans your network, checks encryption and password strengths, blocks infected sites and isolates compromised devices. Asus' parental controls are available and enable you to bind devices to people and set-up timed access. There are numerous pre-sets for kids and adults including content filtering (just note that the latter is always fallible).

"At $169 Asus' RT-AX1800S is great value and we've already seen it for closer to $100 on sale."

Other settings let you extend Wi-Fi range with a mesh network using other Asus routers plus all the other standard router tasks. Everything is also available via an impressive desktop web browser layout. It would be an excellent complement of features for a premium router, frankly.

We tested performance in our one-storey, Sydney weatherboard house by wirelessly transferring large video files between a wired Synology NAS and a Dell XPS laptop. As there are only two bands –2.4GHz and 5GHz – we used the faster, latter for testing. Up close it managed 513.5Mbps, two rooms away it halved to 260Mbps while 15m away, at the end of the garden, it managed 36.3Mbps.

For a budget, two-band router, these scores are rather impressive and rival some much more expensive devices. Just note that the lack of headroom afforded by multiple channels and backhaul, mean that performance will fall away quickly if many people and devices are using the same network. But, for casual Wi-Fi households, it's very good.

At $169 Asus' RT-AX1800S is great value and we've already seen it for closer to $100 on sale. A similarly performing alternative is the Mercusys MR70X which has been in the market long enough to remain under $100, but the Asus looks and feels higher quality and offers better features. It's a great buy.

VERDICT

★★★★★

Casual users will struggle to see the difference between this and much more expensive routers.

Nick Ross

SPECS SPEED Wi-Fi6 1,800Mbps; **CONNECTIVITY** 4 x Gigabit Ethernet LAN, 1 x Gigabit Ethernet WAN; **FEATURES** dual-Core CPU, parental controls, AiProtection, QoS, Alexa compatible.

PRICE $999 **WEB** samsung.com/au

Samsung M8

This hybrid monitor-smart-TV could be your new best M8.

Samsung's next generation of hybrid living room PC monitors are here and they're determined to transform the plug-and-play computer screen into something that can be much more. The new M8 is a 32-inch 4K PC display that can connect to a PC just like any traditional monitor using HDMI or USB Type-C. This work-oriented screen uses a 3,840 by 2,160 pixel VA panel that offers a 400 nit typical brightness and 60Hz refresh rate.

These top line specs make it seem like a pretty standard 4K work monitor offering, but with a $999 price tag you'd really be hoping for some good gaming specs or the ability for professional colour work. The M8 monitor however, offers neither. In fact it's probably not even as good as your average 4K work monitor, since Samsung uses VA panel technology on a screen that isn't overly bright. Sure it has a detailed picture, but the colours aren't as vibrant as what you'd find on similarly priced IPS monitors or premium laptops.

This might seem disappointing at first, but the M8 Smart Monitor offers a very different kind of experience to your average computer screen so it's perhaps not really fair to compare them to standard PC monitors. What we're talking about of course is the Smart TV functionality which adds a diverse set of connectivity options to allow you to watch media, stream games or use your smartphone as a Chromebook-like PC replacement. All this added functionality requires on-board processing from a smartphone-level processor baked directly into the M8 Smart Monitor.

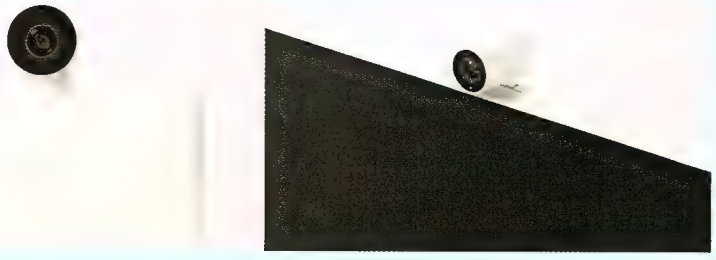
The TV component of the M8 offering is powered by the Samsung TV plus app which has thousands of free-to-air channels on offer. They're not the same free-to-air channels as your usual TV (and there's no digital aerial input), but the main TV stations have catch up apps that allow you to easily watch live TV these days so you can get workarounds for a full TV offering.

The M8 comes with a neat TV remote to control media when you're on the couch and the Tizen OS based device is capable of running apps like XBox Game Pass Ultimate and Nvidia GeForce Now to stream games directly without the need for a computer or console. Controllers connect directly to the TV via bluetooth allowing you to play on the television for anyone signed up to one of these novel game streaming subscriptions.

Webcams have become a much more significant fixture in a post-Covid world and so Samsung's inclusion of a dedicated webcam and microphone array and integration of software like Google Meet is a useful perk. Even if the webcam experience isn't quite what you can expect from the best professional laptops.

So while it might not be the most vibrant or colour accurate monitor around, it's definitely the smartest and most feature rich living room PC monitor we've seen. You'll have to forego DisplayPort connectivity and it feels expensive when considering screen performance, but the smart TV and game streaming functionalities add up to a unique proposition that you'll struggle to find elsewhere.

SPECS 32-inch VA display at 3,840 x 2,160 pixel resolution; 400nit typical brightness; HDR10+; 99% sRGB colour; 60Hz refresh rate; Tizen OS; HDMI 2.2; USB 3.2 (65W power throughput); Bluetooth 5.2; 71.3 x 61.6 x 20; 7.2kg.



VERDICT

★★★★

A 4K work monitor that trades some picture quality for unique smart TV functionality.
Joel Burgess

PRICE $449 **WEB** row.hyperx.com

HyperX Vision S

A 4K webcam for those with a vision of going pro

Webcams are the kind of thing that you don't really think about until right before a big meeting or interview and this general lack of awareness makes it a particularly difficult product to get right. There's a lot of tech in cameras to get images looking right immediately, but webcams are used infrequently and can't be overly expensive. This means the Hyper X Vision S is stepping into a difficult arena with this webcam, even if it does have the Poly (formerly Plantronics) team to lean on.

If you look at the specifications, the Hyper X Vision S is much more capable than your average office webcam allowing frame rates of up to 60Hz and delivering 4K resolutions, if you want them. This is probably a bit more than what you really need for your average conference, even if you have an exceptionally fast internet connection that can handle a 4K stream, but it starts to become relevant for content creation and streaming – if that's your bag.

To back up the content creation hardware the HyperX Vision S offers a decent array of customisable settings to get a more detailed picture quality. What isn't offered with HyperX's Ngunity software can usually be corrected by a filter or colour balance setting on the video capture software you're using to give an overall high-res video that can be resized and colour calibrated for your purpose.

SPECS Sony Starvis 8MP Sensor; 90-degree FOV; 4K 30fps, 1080p up to 60fps, H.264 or MJPEG format; Auto focus; privacy shutter; HyperX Ngunity software; screen clip, 1/4 -inch tripod thread mount; Windows Hello IR; 9 x 4.2 x 4.2cm.

"The Hyper X Vision S is much more capable than your average office webcam allowing frame rates of up to 60Hz and delivering 4K resolutions"

If you're planning on using it as a more traditional webcam it might not be quite as useful depending on the software you use it with. HyperX quotes compatibility with Teams, Zoom OBS and Discord, but we didn't have great results with Google Meet which kept dropping frames (even when we tweaked the framerate) and the low 720p resolution maximum made the image look overly compressed. Fortunately it was better with the other web meeting tools.

We tested the camera against the inbuilt webcam on a Microsoft Surface Laptop Studio which has a max resolution of 1080p. The HyperX Vision S was actually a little behind the inbuilt webcam when it came to auto brightness adjustments when we ran them side-by-side on OBS Studio. The Surface Laptop Studio automatically dealt with a dark-room- light background setting much better than the Hyper X Vision S. It's a bit disappointing that HyperX wasn't at least as adept at adjusting brightness to prioritise faces, but it did a good enough job to not be problematic. It did mean the background details on the Vision S stream were less overexposed than the inbuilt webcam, which will appeal more for content creators interested in overall image, but it's worth noting if you're planning on using this primarily as a webcam.

The screen mount clip is easy to use and worked well on the devices we tested, the quarter inch tripod mount is handy for when you're leaning into content creation and the braided cable was good quality (although we wish it had an adapter to allow USB C to C connections).

VERDICT

★★★½

A pricey high-resolution webcam for those keen on premium content creation.
Joel Burgess

1 Logitech G Yeti GX
2 Logitech G Yeti Orb
3 Logitech G Litra Beam LX

PRICE Yeti Orb $99.95 | Yeti GX $249.95 | Litra Beam LX $269.95 **WEB** logitechg.com

Logitech G Yeti GX, Yeti Orb & Litra Beam LX

Solid offerings for streamers who use Logitech gear, but what about others?

Logitech has set its sights on the streaming market with three new peripherals. Sharing the familiar G-series design cues the Yeti Orb microphone, Yeti GX microphone, and Litra Beam LX RGB key light compliment the plethora of keyboards, mice and accessories already available in the range.

The $99 Yeti Orb is a curious offering. You get a basic condenser microphone built into a pleasingly shaped sphere on a small plastic tripod, with some small RGBs adorning the top and rear. That's it. Plug it in and you're done. It's pitched at entry level users who want or need plug and play and certainly performs better than most gaming headset microphones. It lacks dynamic range and definition, though performance can be improved using the included 'Blue Voice' software in the G Hub application.

The Yeti GX steps it up in quality with a dynamic supercardioid setup. You can tell the DNA of the original and legendary Blue Yeti is alive and well, but at $249 you are paying multiples more than the Orb and it competes with some serious talent on offer for the same money. A mute button is there with a scroll wheel for adjusting gain. It sticks with the all-plastic construction but it's very sturdy. Performance wise, the low-end sounds compromised against the mids which clearly get all the attention. It does a good job of preventing plosives and you couldn't call it sibilant, but you would expect some more clarity for your hard-earned. Again, the software helps tremendously and with time and effort you will likely be satisfied with the results.

The desktop stands however leave a lot to be desired. Both the Yeti GX and the Yeti Orb are pitiful at dodging desktop bumps and keyboard chatter. They pick up every little sound. Put them on a boom arm and obviously things improve, but if you want to sit it on the desktop you may be disappointed without the use of suppression and a noise gate in Blue Voice.

The standout product in this range is the $269 Litra Beam LX. It does an excellent job of casting a bright, clear, well-diffused light. The elongated shape is a clever design and multiple stand mounting points mean it can be positioned in any number of ways to give you the right look on your stream. The rear RGB array gives off a pleasant ambient glow, colour temps and RGB are infinitely configurable, and everything syncs to your Logitech devices through the Lightsync function in the G Hub software.

Which brings us to the value proposition. If you own other Logitech gear, particularly a G series keyboard and mouse these will fit right in. With some setup work your streams will look and sound great but you are paying a premium for this privilege. If you aren't in that ecosystem, it's hard to justify the spend on the mics as there are definitely better options out there. However, the Litra Beam LX works well as a standalone purchase.

SPECS YETI GX: Dynamic Supercardioid Microphone w RGB, gain and mute; 24bit / 96KHz quality, 50Hz-18KHz frequency response; Lightsync compatible, Blue Voicesoftware. **YETI ORB**: Condenser Cardioid Microphone w RGB; 24bit / 48KHz quality, 70Hz-20KHz frequency response; Lightsync compatible, Blue Voicesoftware. **LITRA BEAM LX**: Dual-Sided RGB Streaming Key Light; 42mm X 400.6mm x 35.43mm; Bi-colour 2700K - 6500K; RGB 16 million colours; Up to 400 Lumens + on Bi-colour side; Lightsync compatible.

VERDICT

★★★★
Yeti GX

★★★½
Yeti GX

★★★
Yeti Orb

Key light is lovely; the mics could be better. Logitech ecosystem seals the deal but price/performance not there for everyone else.
Chris Radvan

PRICE $239 **WEB** logitechg.com

Logitech G PRO X Superlight 2

Hold it down or it'll float away.

That Superlight name isn't just marketing guff – this thing very nearly floats off your mouse mat. At just 60g, it's 3g lighter than its predecessor, and while that kind of difference is lost on a decidedly mediocre gamer such as myself, there's no denying this is a beautifully nimble pointer.

Impressively, it clocks up this lighter weight without cutting any holes into its frame, meaning it looks like, you know, a normal mouse. In fact, it's 8g lighter than the hole punched SteelSeries Aerox 3 Wireless, and manages to do so without looking like an RGB cheesegrater.

Instead, you'll find a comfortable, sturdy frame that doesn't mess with the classics. No outlandish swoops and curves, no overabundance of buttons, and certainly no RGB. The pared-back design keeps things simple and – for bonus points – doesn't blind you with flashing lights. There is a pink colour option, sure, but it doesn't glow in the dark.

The reduced weight is not the only upgrade over the previous version, though. There's a new Hero 2 sensor, the maximum DPI has increased from 25,600 to a frankly obscene 32,000, while the polling rate has doubled to 2,000Hz.

"The maximum DPI has increased from 25,600 to a frankly obscene 32,000, while the polling rate has doubled to 2,000Hz."

Gone is the prehistoric microUSB port (replaced by USB-C), battery life is up from 70 hours to 95, and the once-mechanical switches are now a hybrid of optical and mechanical parts. Many small changes, but they add up.

On the bottom are two PTFE feet that help the Superlight 2 glide effortlessly over your mouse mat. The effect on gameplay is superb, and it excels in fast-paced shooters. The new Hero 2 sensor is quick, accurate and wonderfully consistent – perfect for charging around a *Call of Duty* map like a headless chicken (my specialty!). In slower games where you don't necessarily need the low weight and gliding smoothness, you still appreciate them over heavier, clunkier alternatives.

One benefit of the lack of RGB (apart from keeping my retinas intact) is the extensive battery life you get with the Superlight 2. Logitech quotes 95 hours, and while that's not the longest innings we've ever seen, it should last you a couple weeks before needing to be juiced up again.

To check the battery life, you've got to open up Logitech's G Hub app, which (let's be honest here) isn't great. Assigning macros is confusing, and while there is a ton of depth and control when it comes to DPI options, my app had a habit of resetting my DPI whenever I opened a full-screen game, until I finally figured out how to nix the accursed behaviour.

Speaking of DPI, the Superlight 2 lacks any way to change this on the mouse itself – there's no button – so you have to wade into G Hub every time you want to adjust it. It's all part of the understated physical design, which I suppose could also be described as a touch unimaginative. If RGB is your thing, you might want to look elsewhere.

VERDICT

★★★★

Seriously light and slides nicely. Incredible battery life, but there's no DPI button.
Alex Blake

PRICE $369 **WEB** logitechg.com

Logitech G PRO X TKL Lightspeed

Keyboard perfection.

Here's Logitech's newest and most premium wireless keyboard. At close to $400 it's certainly premium-priced, but is it worth the high cost? Out of the box impressions say yes. The build and materials are absolutely top notch. It's rock solid, somewhat heavy to stay in place during gaming rage, and simply feels like quality all over. I was sent the white version for review, and it's also available in black or bright pink.

The layout is exactly the same as the 915 TKL that we've previously awarded Best Keyboard in our Australian PC Awards. It's a damn-near perfect arrangement, with everything you need and nothing you don't. There's dedicated buttons to switch between Bluetooth and the 2.4GHz 'Lightspeed' wireless mode. That makes it super handy to rapidly use with your TV or any paired device that you might only occasionally need a keyboard for. A gaming button disables the Windows key, and that button itself can be remapped to whatever you like. Media controls and a delightfully convenient volume roller round out the extra functions.

Onboard lighting controls disappointingly don't include colour selection. You can use the lighting button in conjunction with number keys to select effects and brightness, but not the actual colour. So if you just want a solid colour you're stuck with cyan unless you want to install the Logitech G Hub. The app itself is decently sensible, and there's the option to save presets to onboard memory, which can be chosen on the fly via assigned keys. It's also possible to completely remap keys or combos via the app.

Key choices are Linear, Tactile or Clicky. These are roughly analogous to Cherry Brown, Red and Blue. I tested the Linear version. Compared to the Cherry equivalent the Logitech linear mechanism is slightly chunkier in movement, with quite a long throw. There's absolutely no wobble – even with the spacebar, which is properly Mercedes car door smooth. Of course it comes down to personal preference, but these linear switches are, to my fingers, much nicer to use than a Cherry Brown. The keys have good spacing between them and in day to day typing it's a flawless experience, and it's nearly impossible to make finger-fumble typos. It is a bit loud to use, though, with each depression registering a very solid clunk. But, dare I say, it's the quality of the switches and keys you are feeling and hearing here. I've spent many non-stop hours typing on this and I'll be genuinely sad to change to anything else, now.

Marketed under Logitech's G brand, it is ostensibly a gaming board, and in FPS games it's a gem, but understandably there will be many who prefer a more adorned board with dedicated gaming macro keys. For the rest of us FPS gaming is a great experience, offering precise and positive inputs.

It's one of the nicest keyboards we've ever used, perfect for daily driving and gaming. The quality is super impressive and it's a lovely design that's all about function, which to my eyes makes it also look beautiful.

VERDICT

★★★★½

Form and function in a keyboard that delivers just about everything.

Ben Mansill

"The layout is exactly the same as the 915 TKL that we've previously awarded Best Keyboard in our Australian PC Awards."

apc EDITOR'S CHOICE

PRICE From $549 **WEB** store.google.com/product/pixel_watch_2

Google Pixel Watch 2

Google's second-generation watch improves its formula enough to stand out from the crowd.

The Pixel Watch 2, encapsulated by its tagline "Help by Google. Health by Fitbit," is a product that seamlessly blends both ideas. Despite looking identical to its predecessor, including the single size option, the Watch 2 has undergone significant improvements internally. Now lighter due to the use of aluminium instead of steel, the sensor array on the back thanks to the new multi-path heart rate sensors which affords it a tenfold increase in tracking accuracy is basically the only give away that you're looking at the Pixel Watch 2.

The old wireless charging puck has been replaced with a direct pin contact puck that's still magnetic, but improves charging times by over 35 minutes, allowing for a full charge in just 75 minutes. Internally, the watch has received a major upgrade with Qualcomm's 5100 chipset, addressing the battery life and speed issues that were a concern with the Watch 1. As a result, the Watch 2 is buttery smooth to operate and its battery now easily lasts 24 hours.

With the always-on display disabled, days typically ended with 30% battery left. More demanding tasks like a two-hour GPS-tracked bike ride or playing downloaded music via Bluetooth earbuds for an hour can each drain the battery by around 20% though. Despite this, its battery performance is now on par with other high-end smart watches and by utilizing battery-saving modes, it's possible to get two full workdays of mild use out of it which reduces any battery anxiety.

As a Fitbit user, the health and fitness aspect of this watch is comfortably familiar and still impressive. The recently updated Fitbit app and extra features that come with the free six-month Fitbit premium membership can give you statistics overload. Android Fitness enthusiasts need not look any further; this is the watch for you.

The Pixel Watch 2 runs Google's newest Wear OS v4 and supports many Google and third-party apps and continues to be a strong point of the Wear OS ecosystem over other Android compatible alternatives.

Google Assistant is very well integrated into the watch and can perform specific tasks like showing step count, heart rate or even turning the watch into a torch. The same on-device speech recognition subsystem is also available anywhere you might use the keyboard, as voice-to-text input, and works very well and is often easier to use. Overall, the integration between your wrist and your Android phone is the best I've seen yet, as you'd expect from the maker of Android.

This watch also provides segment leading personal safety features like medical information for first responders, location sharing, emergency SOS, fall detection and safety check.

With the Pixel Watch 2, Google has caught up to other premium smart watches on the market and offers some unique and even leading features. For a future Pixel Watch 3, Google should be looking to offer a larger sized model and reducing the chunky screen bezels.

SPECS 1.2" 450 x 450 AMOLED display with 3D Corning Gorilla Glass 5, 5ATM water resistance and IP68 rating, Qualcomm 5100 chipset, 2GB SDRAM, 32GB eMMC flash, Bluetooth 5.0, Wi-Fi 2.4 GHz, NFC, GPS, compass, altimeter, SpO2 sensor, ECG sensor, multi-path heart rate sensors, accelerometer, gyroscope, EDA and skin temperature sensors, barometer, magnetometer, 306mAh battery, 41mm diameter, 12.3mm height, 31g, Google Wear OS 4, 2yr warranty.

VERDICT

★★★★½

Improved battery life and full suite of features make this worthy of consideration, especially if you're already in the Fitbit ecosystem.
Mark Williams

PRICE Free **WEB** www.snipca.com/47453 **NEEDS** Windows 10 or 11, macOS or Linux

Vivaldi 6.2

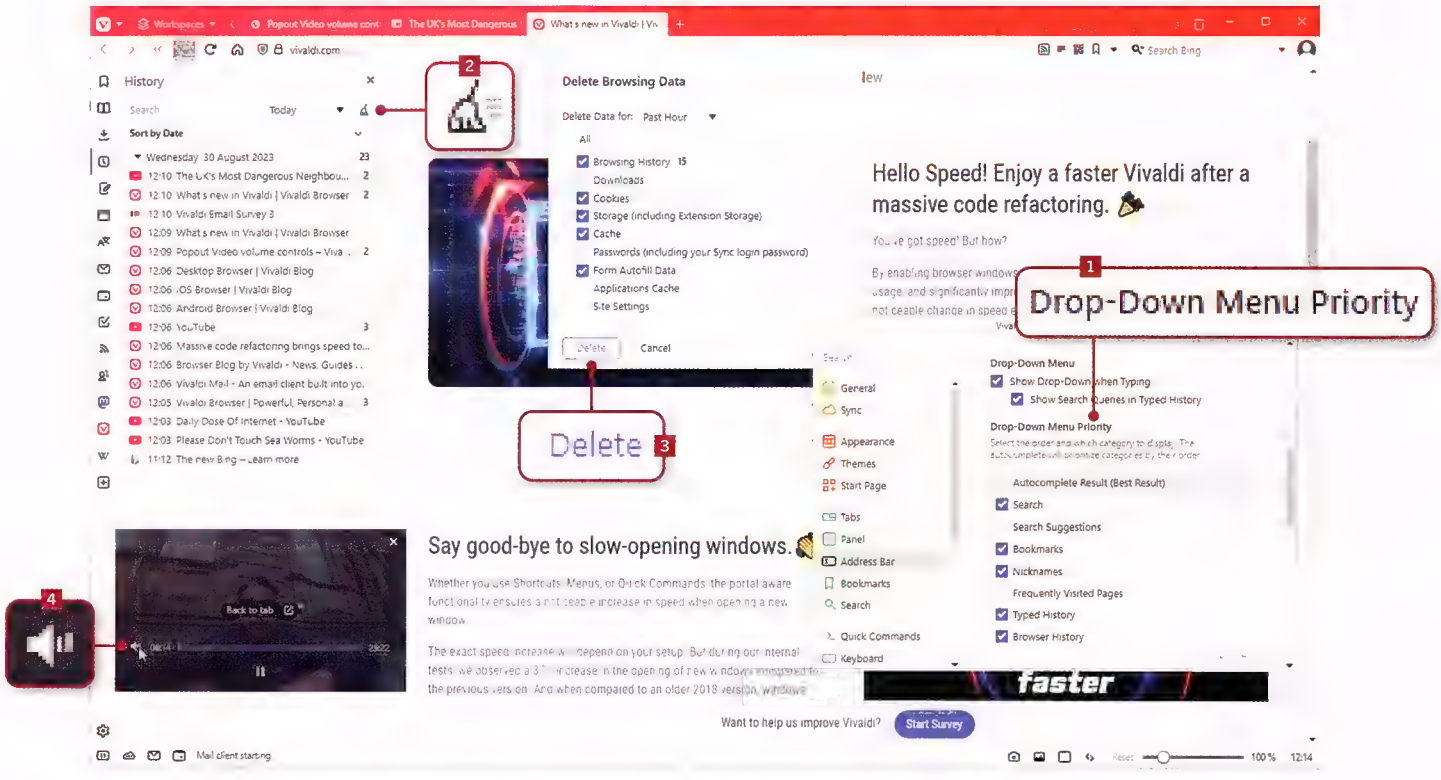
A better browser.

Vivaldi has long been one of the most innovative browsers, with each new release making significant changes – rather than the incremental updates you get in Chrome and Firefox. Version 6.2 is a major milestone because it 'refactors' the browser's code to reduce memory usage and improve performance. Vivaldi says you can now open new windows 37 per cent faster than before.

Besides that 'under the bonnet' change, there are several new features that enhance your browsing experience. One of the most useful is the ability to change the order of the auto-complete suggestions that appear in Vivaldi's address-bar dropdown menu. You can now prioritise your preferred entries, such as matches from your bookmarks, browsing history or pages you visit frequently. Right-click the address bar, choose Customise then scroll down to the Drop-Down Menu Priority section. Select a category and either click the up or down arrow to change its order, or untick/tick its box to exclude it from/include it in the dropdown menu.

Another welcome addition is the new 'Clear browsing data' button in the browser's History panel. This lets you delete browsing data including your history, downloads, cookies, passwords and cache, whether only for the past hour, day or week – or entirely. Click the clock icon in the sidebar to open the History panel, then click the 'Clear browsing data' brush icon to choose what you want to delete.

Vivaldi 6.2 also makes it easier to subscribe to YouTube channels without signing into a Google account, so you can watch videos privately on the site. When you're viewing a channel, click the new Feed Reader icon in the address bar to subscribe to it as an RSS feed. New videos in that channel will then appear in the browser's Feeds panel. The icon wasn't appearing at the time of writing, but Vivaldi should have fixed it by the time you read this. ■



1 Change the priority of auto-complete suggestions in Vivaldi's address-bar dropdown menu by selecting the categories you want to include then clicking the arrow buttons to move them up or down.

2 To delete your browsing data without delving into Vivaldi's settings, click the History button to open the History side panel, then click the 'Clear browsing data' brush icon in the top-right corner.

3 Tick the boxes for the types of data you want to delete, such as your browsing history, downloads, cookies, passwords and form autofill data. Select the period of time you want to clear, then click the Delete button.

4 Vivaldi has added volume controls to its pop-out video player, which means that when you're watching videos in a floating window, you can now adjust and mute the sound from outside of the source website.

AUDIO TOOL

EarTrumpet 2.3

WEB www.snipca.com/47451 **NEEDS** Windows 10 or 11

EarTrumpet improves the volume control in Windows 10 and 11 to make it easier to adjust the audio levels of different software and hardware on your PC. Install the app from the Microsoft Store, then click its system-tray icon – this looks exactly like the Windows speaker icon (see screenshot), but may be in the 'Show hidden icons' flyout menu (click up-pointing arrow to reveal this) . EarTrumpet will show you individual sliders for all your audio devices and sound-enabled programs, which you can drag left or right to decrease or increase their volume. The latest version of the app lets you use the scroll wheel on your mouse to adjust speaker volume when you hover your cursor over its system-tray icon. Right-click the icon and choose Settings then 'Mouse settings' to turn this option on or off. You can also enable an option to move EarTrumpet's sliders by scrolling the wheel.

DUPLICATE CLEANER

Wise Duplicate Finder 2.0.4

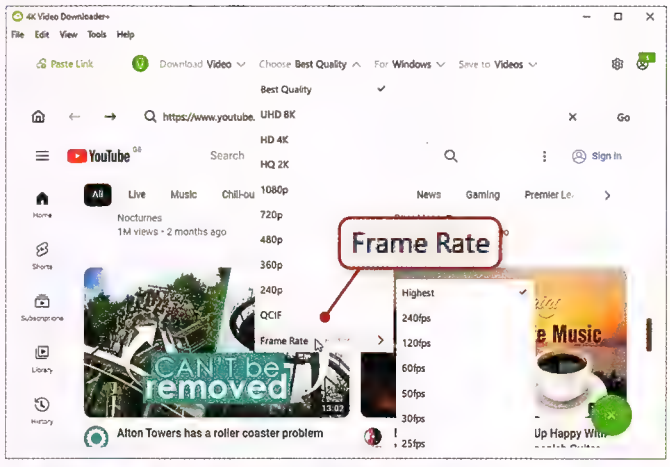
WEB www.snipca.com/47452 **NEEDS** Windows 7, 8.1, 10 or 11

Wise Duplicate Finder is one of the simplest and fastest tools for finding and removing duplicate files. Although the free version lacks the 'Keep One' option, which deletes all unwanted copies in one click (to get this, upgrade to the Pro edition for $28 a year), you can easily remove files manually (see screenshot) – and restore them from the recycle bin if you delete the wrong item. This update introduces the ability to preview entire image files when you're reviewing your scan results, rather than just segments, to help you confirm pictures are duplicates. Additionally, it fixes a bug that caused 'abnormal' behaviour when previewing 0-byte image files. Wise has also added extra file paths to Duplicate Cleaner's Exclusion list to prevent it from including irrelevant folders in scans. Note that, as of this version, Wise Duplicate Finder no longer supports Windows XP or Vista.

"Although the free version lacks the 'Keep One' option, which deletes all unwanted copies in one click, you can easily remove files manually (see screenshot) – and restore them from the recycle bin if you delete the wrong item."

Should I pay for?

Choose the right version of software



"There are several paid-for editions of the program, of which Personal is the best value because it's a one-off purchase"

4K Video Downloader+ Personal

WEB www.snipca.com/47454 **PRICE** $25 Free trial period: N/A
NEEDS Windows 10 or 11, macOS or Linux

4K Video Downloader has a new '+' version, but recommended using the free tool Vividl (**sourceforge.net/projects/vividl/**) instead. Sadly, the latter is no longer working reliably, so we decided to see if 4K Video Downloader+ is worth paying for.

There are several paid-for editions of the program, of which Personal is the best value because it's a one-off purchase – the Lite plan has the same features, but costs $15 a year, while the business-oriented Pro version costs $45. All plans have a 14-day money-back guarantee.

Personal lets you download an unlimited number of videos every day from websites including YouTube, Vimeo, TikTok, Flickr and Facebook, whereas the free version limits you to 30. You can save as many videos from a YouTube playlist or channel as you want, complete with subtitles, with up to three simultaneous downloads – again, the free program imposes restrictions. It's also possible to download 'private' YouTube videos, provided you have permission to do so.

The big new feature in 4K Video Downloader+ is a built-in browser that lets you search services and download videos directly within the software, rather than having to paste links into it.

The program's Smart Mode has also been improved to make it easier to download video (and audio) in your preferred format and quality (up to 8K), including a specific frame rate (see screenshot).

OUR VERDICT: PAY FOR IT
If you download lots of videos from YouTube and other sites, 4K Video Downloader+ Personal is worth the investment, if only to remove the limits and upgrade nags of the free version. The revamped program is slicker and faster, and the in-program browser saves you a lot of time and hassle.

Work with footage at up to 4K, 60fps without missing a beat.

PRICE $7.99/month, $59/year (one-month free trial) **WEB** apple.com/au | **NEEDS** iPadOS 16.4 or later and an iPad with M1 or M2 chip

Final Cut Pro for iPad

Studio-quality editing comes to iPad.

When Apple released content-creation apps Final Cut Pro for iPad and Logic Pro for iPad at the same time, this reinforced the idea of the device as a tool for creative professionals. While Logic Pro runs on all recent iPads, Final Cut Pro is restricted to models with an M1 or M2 chip due to its demands on your iPad's graphics hardware. That will disappoint some people but Apple often decides to omit older models rather than risk a poor user experience.

As with Logic Pro, Apple has done a great job of adapting the interface for touch while retaining a look and workflow familiar to existing users. Working with video clips using touch is intuitive and fast, and there's Apple Pencil support not only for general usage but also for drawing or writing directly onto clips, which the app can then animate. A physical keyboard is supported too and while not every Mac keyboard shortcut has made the, erm, cut, more were added in the 1.1 update.

You can import footage from connected or cloud drives or record directly from the camera, with the latest iPads allowing ProRAW capture on-device. You cannot work on footage from a USB-C drive, however, so you will be reliant on your iPad's internal storage.

Features such as Cinematic mode are supported when editing, so you can refocus footage after the fact, and some colour lookup tables (LUTs) are available for grading, although you can't yet import your own.

Editing is quick and smooth and you'll find some pretty advanced features including multi-camera editing and sync, machine-learning-powered fast editing, keyframing, live drawing and masking. There's also titling and transitions, extensive clip-based controls and a decent selection of video plus a few audio plug-ins, which we'd expect to see expanded in time. 40 music tracks are included with a clever auto feature that matches music duration to your project, though there's no clip stabilisation at present which some users will really miss. A virtual jog wheel however is a great workflow enhancer.

You can finish your project on the iPad and export it in a range of formats from full-quality 4K HDR to social media versions. You can also export it to Final Cut for Mac to take advantage of the desktop's bigger range of tools and plug-ins for further editing, though to move back to iPad after that involves limitations.

This is an excellent first step for Apple with many core features present and correct, even if some others are more likely to appear in updates. Pricing is reasonable and the month's free trial helps you to decide whether to go ahead and subscribe. ■

"There's Apple Pencil support not only for general usage but also for drawing or writing directly onto clips, which the app can then animate."

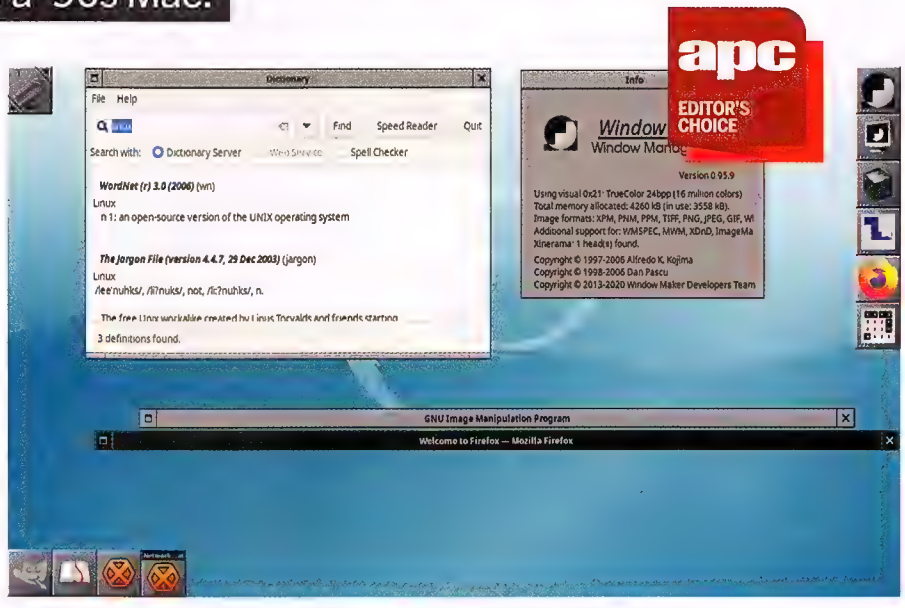
An excellent video editor for the latest iPads, though falls a little short of the desktop version. **Hollin Jones**
★★★★☆

DEVELOPER Window Maker Developers **WEB** www.windowmaker.org **LICENCE** GPL 2.0+

Window Maker Live

Nate Drake gets into the frame of things with Window Maker – a desktop experience reminiscent of a '90s Mac.

In describing Window Maker, we can do no better than quote the homepage: "Window Maker is an X11 window manager originally designed to provide integration support for the GNUstep desktop environment, although it can run standalone. In every way possible, it reproduces the elegant look and feel of the NeXTSTEP user interface."



Our Window Maker desktop in Xubuntu. Double-click title bars to hide windows. Create shortcuts by dragging icons to the app dock.

NeXTSTEP was an operating system based on Unix-derived BSD. After its developer's acquisition by Apple in the mid-'90s, elements of the NeXTSTEP GUI were integrated into OS X.

If you feel like a trip down memory lane, the good news is that Window Maker is compatible with virtually every Unix-based OS, including Linux, Solaris and BSD.

If you're used to installing via a graphical software centre, the bad news is that this cross-platform compatibility comes at a price, as the main page advises compiling the program from source.

In theory, this isn't a major issue, as the website documentation section has an installation guide. Sadly, this is where we ran into snags, though we were able to compile and install wmaker on Ubuntu and Peppermint OS (which uses XFCE), subject to installing all the required dependencies, such as libjpeg-dev, which helps to display different backgrounds.

But when we tried to choose Window Maker as the window manager from the login screen, the desktop failed to load. We eventually managed to get a session running in an Xubuntu VM by installing wmaker and wmaker common from the Ubuntu repositories.

Assuming you succeed in launching Window Maker, you'll discover a few minimalist icons floating around the desktop. Right-click to configure system settings and launch applications. This interface will be familiar to anyone who's used Xfce (or indeed NeXTSTEP), in that disabled options are greyed out. Options marked with a triangle can be selected to open a submenu.

If you use the menus to launch an application, a corresponding square appicon opens at the bottom of the screen. You can click the minimise button at the top-left of any window to iconify it. If you select individual windows, the title bar appears black. This is referred to as a focused window in the documentation, which can do things such as accept keyboard inputs. Windows can also be shaded by clicking on the title bar. This hides everything except the title bar itself. You can also move and resize windows by clicking and dragging the title bar or dragging borders respectively.

The documentation states that the right-hand side of the desktop contains an application dock, which you can use to launch familiar apps via a double-click. Although this was notably absent in our tests on an Ubuntu 23.04 VM, it appears you can add new apps via dragging and dropping their icon into the dock.

The Window Maker website contains a number of themes to overhaul its look and feel. The Themes page explains that installing is a simple matter of unpacking the tarball to ~/GNUstep/Library/WindowMaker.

When we tried this in an Ubuntu Gnome 23.04 VM, the system crashed. Fortunately, the website has a large collection of screenshots where better men than us have succeeded in configuring the UI to their needs.

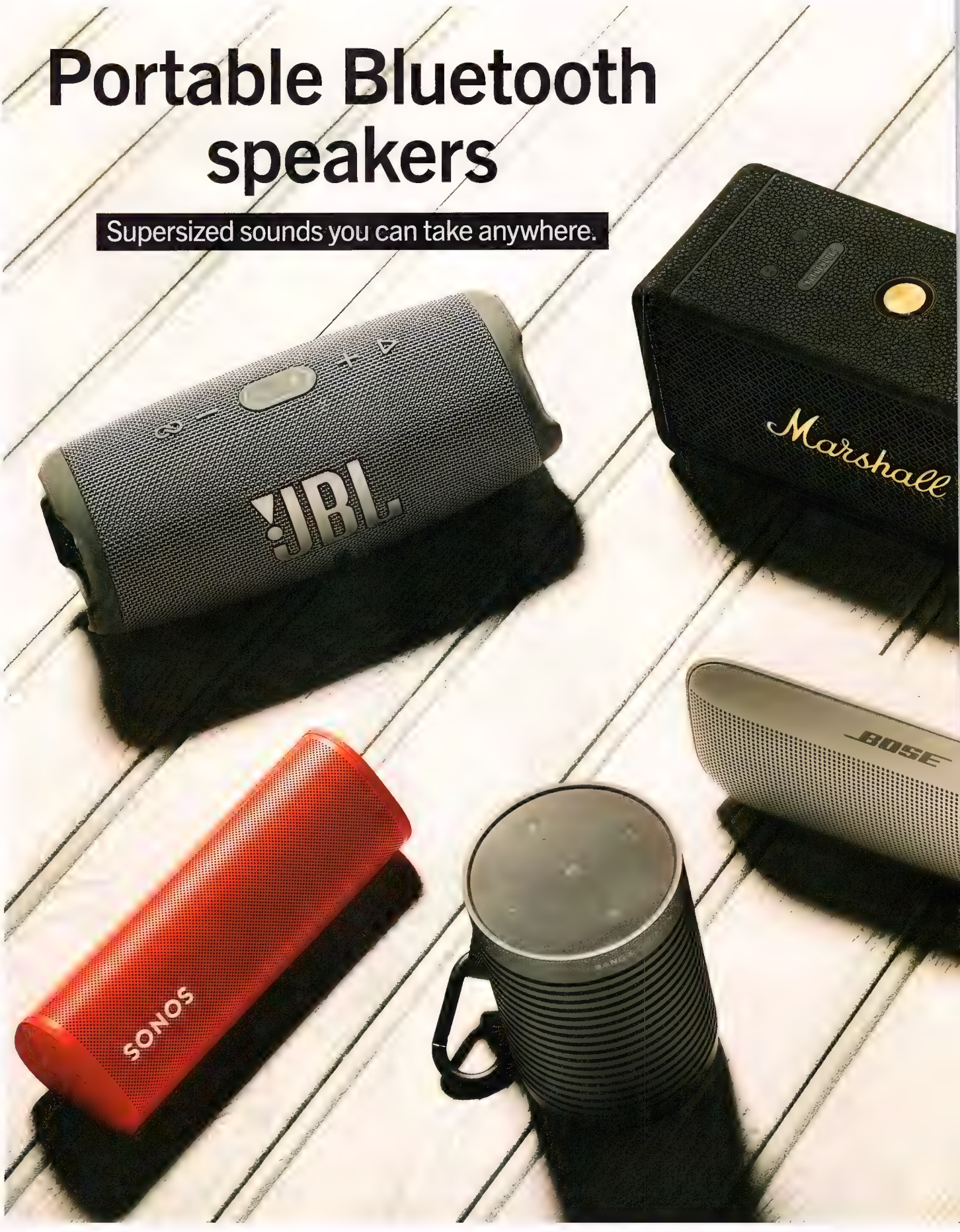
If you have your heart set on a nostalgic desktop experience and find default X sessions just aren't doing it for you, you can relive the early days of OS X via Window Manager. We recommend compiling and executing the source code in a VM first, though. ■

"The good news is that Window Maker is compatible with virtually every Unix-based OS, including Linux, Solaris and BSD."

Window Maker enables you to relive the glory days of Mac OS X, but setup and configuration could be easier. **Nate Drake**
★★★★½

Portable Bluetooth speakers

Supersized sounds you can take anywhere.



There are occasions where you just can't beat a Bluetooth speaker. The case for streaming over the short-range radio frequency versus the longer-range Wi-Fi option enables you to stream wherever you are, there are no power cables involved, and the streaming compression has improved to the point you'd be hard pressed to notice a difference in sound quality when listening to your favourite tracks.

All this makes Bluetooth the ideal choice for the six best portable speakers on test here (the Sonos Roam also has Wi-Fi built in, so the option to stream at home is there). Additionally, all the speakers can be paired with other units, for an even greater sound. As well as being the best-sounding speakers we've come across, they're also very rugged, making them perfect for any outdoor scenario. All of the speakers here are rated to IP67, meaning they are both waterproof (they can be immersed to a depth of one metre) and dustproof. Being so portable, one of the key elements in this test is battery life – more listening time equals more good times.

Group test

Reviewed by **Nick Odantzis**

ON TEST...

B&O Beosound Explore
Bose SoundLink Flex
JBL Charge 5
Marshall Middleton
Sonos Roam
Sony SRS-XS200

How we tested

Each speaker was tested at a range of volumes with high-quality music tracks sourced from the Spotify app. Using a variety of music styles, we checked to see which sounded the best overall, as well as how they performed in an open soundscape (read: our back garden). We also tested the battery life of each unit by playing music at 50% volume on an iPhone 14 continuously for two hours, to see how the remaining battery percentage compared with the manufacturer's claims.

THINGS TO CONSIDER...

Battery life

One of the biggest considerations for portable Bluetooth speakers is how much playing time you're going to get. This is especially crucial if you're heading away for a weekend outdoors.

Carrying capability

Want to carry your speaker with you, or even strap it to a bag? Some speakers come with a strap, or a way to tether it to something.

An app for that

Some speakers come with a supporting app from the manufacturer, allowing you to tailor the settings, update firmware, and more.

Go big, or go... small

Some of the speakers in this test come in smaller (or even bigger) sizes, allowing you to choose the model that best suits your needs.

1

1

B&O Beosound Explore

$400 | bang-olufsen.com

B&O's Beosound Explore is handmade in Denmark, and comes in a variety of classy colours. It's one of the smaller speakers here, but at 631g it's mid- weight, and its ribbed aluminium structure feels as if it could take a licking. It's pricey but, typical of B&O, it's built to a very high standard.

Neat design touches include a grippy rubberised base, carry strap, and a carabiner to attach to a backpack. The basic controls are located on the top section, for easy access and offer glorious responsiveness.

Inside the shell are 2x 1.8–inch full-range drivers, and 2x30W Class D amps. The Beosound Explore offers 360° sound. Not surprisingly, given its size, it struggles with low notes, but it's punchy, and has a clear and bright overall sound. It can go loud, but it'll distort further up the dial; it's better at a more chilled volume in smaller spaces, although you can pair it with another unit for a meatier stereo sound.

B&O claims a massive 27-hour battery life. After two hours at a reasonable volume, we still had a good 93% of charge remaining.

VERDICT

★★★

Great sound for the size with excellent battery life, but it's expensive and struggles at the low end.

2

Bose SoundLink Flex

$195 | bose.com.au

The SoundLink Flex is a compact but chunky rectangular speaker. The powder-coated metal front and rear speaker grille are sheathed in a tough, silicone shell, and it's available in four colours. It can be placed standing up, lying down, or hanging via a fabric loop. It'll also float in water. There's no carry strap, but the body is easy to hold, and it weighs in at 600g. Controls on the side are easy to access.

With Bluetooth 4.2 on board, the SoundLink Flex has less theoretical range than speakers with the newer Bluetooth 5 standard, though we had no issues connecting. It doesn't affect the quality of the audio either, and it's here that this speaker shines. It feels like a bigger speaker than it is, despite the small single driver and front and rear passive radiators. At half volume it's very loud, and the low end is astonishing, but it also sounds delightful at higher frequencies. PositionIQ Technology adjusts the sound EQ no matter the orientation.

Bose says the SoundLink Flex offers a 12-hour battery life, but we actually got about 18 hours, with a drop of only 10% after a couple of hours.

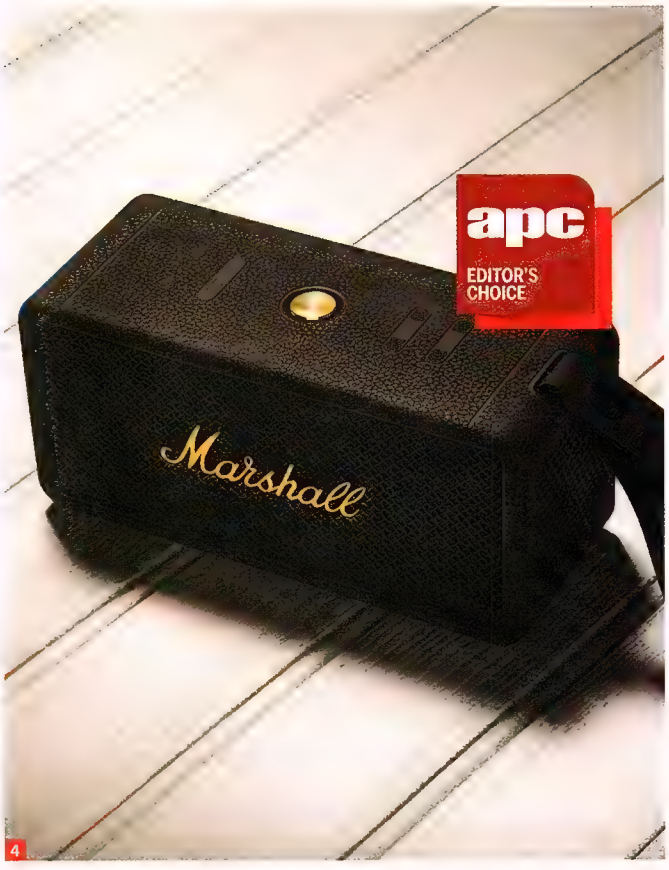
VERDICT

★★★★

Very clear and loud with great battery life, it's decent value though with potentially less range.

2

3



4

3

JBL Charge 5

$169 | jbl.com.au

JBL's Charge 5 is one of the bigger speakers on test, roughly the same shape and size as the Sony. It's heavier though at a pretty hefty 960g.

The Charge 5 is designed to sit lengthways, and has thick rubberised slats on the underside. At either end of the mesh fabric bodywork are protective rubber caps. You get the impression this speaker can handle anything.

On top of the speaker you'll find the controls, with the power and Bluetooth buttons given special prominence. Located at the back, there's a hidden USB-A port for charging devices.

The newer Bluetooth 5.1 streaming standard is on board, and if you really feel the need to amplify audio, or you just want stereo sound, you can connect another unit.

But trust us, you really won't. In isolation, the Charge 5 is a powerhouse. On the inside a driver, tweeter, and dual bass radiators help to deliver an astonishing sound, with impactful lows, dramatic vocals, and crisp, energetic highs. It's just wonderful.

And you'll get 20 hours of listening bliss all told – after two we'd barely left a dent.

VERDICT

★★★★★

Exceptional soundstage and great battery life. Excellent value for money, with external device charging.

4

Marshall Middleton

$449 | marshallheadphones.com

If you want to go big in the audio department, then check out Marshall's Middleton. It's the biggest, heaviest at 1.8kg (for more portability try the Emberton), and priciest speaker here. As usual, Marshall design rules apply, with black plastic grilles front and back, and a tough, textured rubberised shell. Like the JBL, a port (this time USB-C) offers external device charging. There's also a large detachable carry strap.

Controls are spicy, with a single aluminium knob for power, play/pause, and track skipping. Neatly, bass and treble controls sit to one side; to the other a Bluetooth and battery-check button, for at-a-glance battery viewing.

The Middleton isn't just physically big, it's physically capable. Inside there are two woofers, two tweeters, and two passive radiators. It's the loudest here, with hefty bass that seems to dominate, but there's plenty to like in the rest of the spectrum, and it's easy to tailor the sound on the fly. While it doesn't have the spine-tingling sound of the JBL, it's still impressive.

Marshall's claim of 20 hours battery life is spot on; it was still 90% after two hours.

VERDICT

★★★★★

Big and brilliant sounds, excellent design with external device charging, though a bit big and expensive.

5

6

5

Sonos Roam

$299 | sonos.com

Volumetrically, the Sonos Roam is almost on par with the B&O, and it's a similar price. It's lighter, at 430g and, as such, is the most portable here. It comes in five different colours. There's no carry strap but it's easy to hold and stow.

The Roam can be stood upright or placed on its side, and will adjust the sound EQ to suit. Controls are located on the top for easy access, while the power button is at the rear. Uniquely, the Roam can be charged wirelessly through its rubberised base.

The Roam offers AirPlay 2 and Bluetooth, switching between each automatically. You can also connect to other Sonos speakers. Despite its diminutive proportions, there's a decent low end and plentiful mids that are delivered cleanly. The overall audio delivery isn't the most exciting here, but you won't be disappointed either.

Sonos claims a 10-hour battery life, but we reckon that's a bit pessimistic. We found only a 10% drain after two hours, and 20% after four, so depending on volume it should last a while longer.

VERDICT

★★★★

Small and portable, strong low and mid range, but overall audio isn't that exciting. AirPlay 2 option.

6

Sony SRS-XS200

$148 | sony.com.au

As value for money goes, Sony's SRS-XS200 is hard to beat. It's one of the bigger units here, and weighs 800g. It looks great, with its rubberised plastic shell and fabric-covered speaker grilles, and is available in four colours. As well as being IP67 rated, the SRS-XS200 is drop tested to 1.2m. It's not the easiest to hold, but it comes with a nylon strap. Controls are located along the side, and there's a handy battery check button too.

The SRS-XS200 is designed to be stood on its end, to take advantage of its frontal Line-Shape Diffuser, which helps the dual, full-range speakers disperse sound outwards more evenly, and it does seem to work from all angles. You can also rest it on its side and use the app to put it in stereo mode, though the effect is subtle. Standing sounds better, with punch across the range, though the bass is a little wooden, and there is some muddiness in more layered tracks.

16 hours of battery life is impressive. After 2 hours the battery was down to 87%, so not too far off that claim.

VERDICT

★★★

Wide soundstage though audio can get overwhelmed. Drop protection, great value.

The winner JBL Charge 5

An epic, portable soundstage for your summer parties.

Let's just make one thing clear: there isn't a bad-sounding speaker here. We enjoyed listening to all of them, and it's not all about audio; you should consider the other crucial variables, such as size, battery life, and price.

B&O's Besound Explore is a great portable option, with the best battery life by some way, though it's not best suited to bigger spaces.

The Sonos Roam is an even better option for portability, and the sound is overall a little better, while the 10-hour battery life is better than stated. If value is your thing, you could do worse than consider Sony's SRS-XS200, though it's one of the less impressive-sounding speakers in this test.

If you're after sound and portability, Bose's SoundLink Flex is the one to go for, plus the battery life is brilliant. The Marshall Middleton is the biggest option, and it sounds very dramatic, though it's also very expensive.

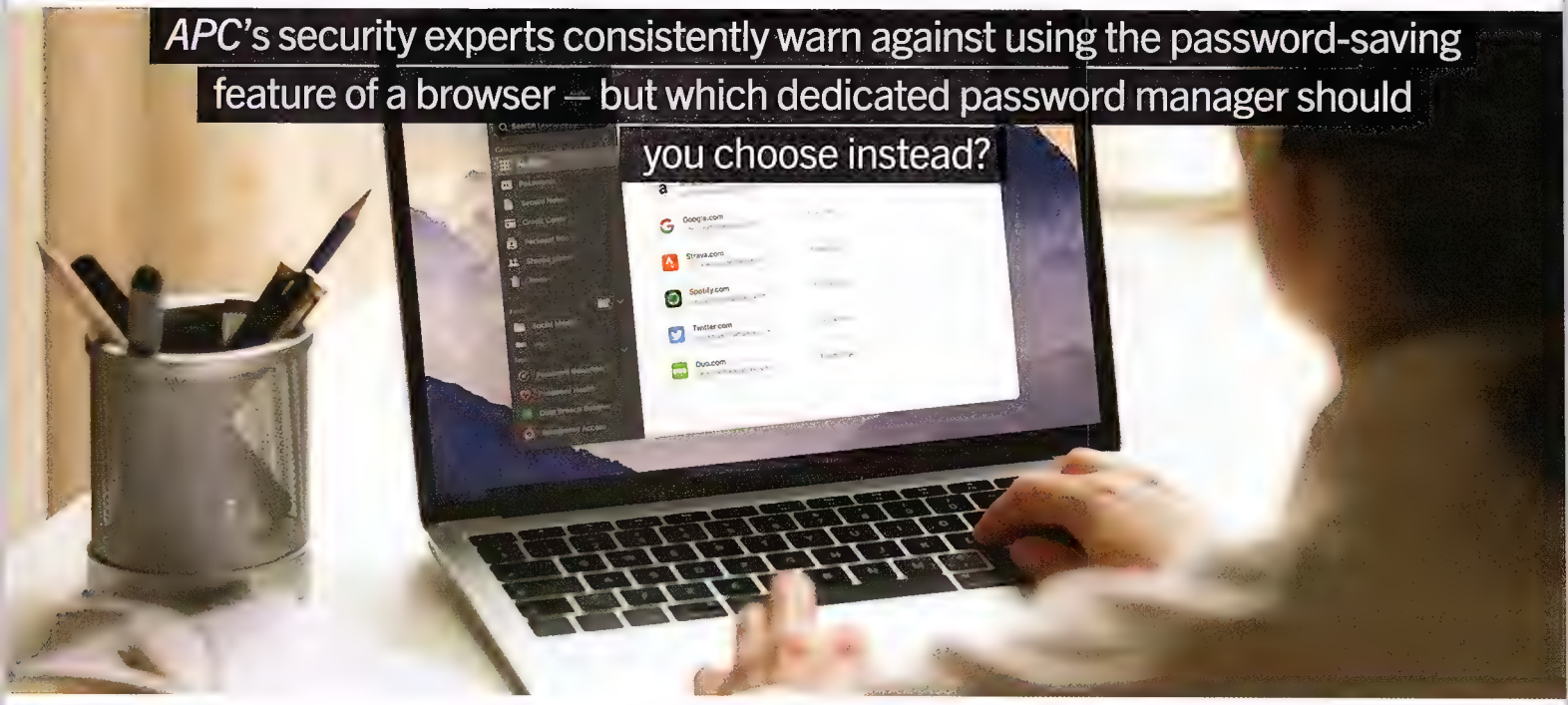
JBL's Charge 5 wins on account of it doing everything better – it sounds simply stellar for one, looks great, has incredible battery life, and is great value.

How do they compare?

	B&O Beosound Explore	Bose SoundLink Flex	JBL Charge 5	Marshall Middleton	Sonos Roam	Sony SRS-XS200
Price	$400	$195	$169	$449	$299	$148
Website	bang-olufsen.com	bose.com.au	jbl.com.au	marshallheadphones.com	sonos.com	sony.com.au
Weight	631g	600g	960g	1.8kg	430g	800g
Frequency range	56Hz-22.7kHz	60Hz-15.6kHz	60Hz-20kHz	50Hz-20kHz	62Hz-18kHz	20Hz-20kHz
External charging	✗	✗	✓	✓	✗	✗
Bluetooth version	5.0	4.2	5.1	5.1	5.0	5.2
Battery life (claimed)	27 hours	12 hours	20 hours	20 hours	10 hours	16 hours
IP rating	IP67	IP67	IP67	IP67	IP67	IP67
Apple AirPlay	✗	✗	✗	✗	✓	✗
Overall	★★★	★★★★	★★★★★	★★★★★	★★★★	★★★

Note: The final verdict scores reflect the overall opinion of a product and are not necessarily an average of the criteria listed in the table.

Password managers



APC's security experts consistently warn against using the password-saving feature of a browser – but which dedicated password manager should you choose instead?

Group test

Reviewed by **Mike Jennings**

ON TEST...
1Password
Bitwarden
Dashlane
Keeper
NordPass
RoboForm

The best password managers make it easy to stay secure online. The concept is simple: all of your passwords are stored in an encrypted online vault, which can only be unlocked with your private master password. Once you've entered this password, the password manager uses the appropriate credentials to log you into which ever site or service you want to access. While most web browsers have built-in password managers, they're not as flexible or secure as a dedicated app.

The password managers on test this month aren't just for individual users. Many of these products are also offered in business-friendly versions (albeit for higher prices). With the widespread adoption of hybrid and remote working, users are increasingly storing business-sensitive passwords on their devices, and IT departments should take a hard look at the security hole this leaves.

On these pages we focus on six of the best premium password managers, honed down from a long list of 30 products that have been put through their paces in terms of security, privacy, storage, compatibility, synchronisation and – of course – price.

How do they compare?

	1Password	Bitwarden	Dashlane	Keeper	NordPass	RoboForm
Free version	14-day trial	Yes	Yes (one device)	30-day trial	Yes	Yes
Individual option	US$2.99 per month	Free (Premium, US$10 per year)	US$2.75 per month	$4.58 per month	US$1.79 per month	US$1.99 per month
Family option	US$4.99 per month (five accounts)	US$3.33 per month (six accounts)	US$4.99 per month (ten accounts)	$10.08 per month (five accounts)	US$2.79 per month (six accounts)	US$3.98 per month (five accounts)
Business version	US$7.99 per month per user	US$3 per month per user	From US$2 per month per user	From $3.48 per month per user	US$3.59 per month per user	From US$3.33 per month per user
Travel mode	✓	✗	✗	✗	✗	✗
Digital wallet	✓	✓	✗	✗	✗	✗
Storage space	1GB per user	1GB per user (paid only)	✗	10GB (family)	3GB (paid only)	✗
Number of devices	Unlimited	Unlimited	Unlimited (paid only)	Unlimited	Unlimited (paid only)	Unlimited (paid only)
Overall	★★★★	★★★★★	★★★★	★★★★★	★★★★★	★★★★

*All prices based on annual subscription rather than monthly billing

Individual, US$1.79 per month | nordpass.com

NordPass

A well-balanced password manager, combining a good set of features with a very reasonable price.

NordVPN is rated highly by us – and the company's password manager is just as impressive. It boasts all the important features, including secure sharing, autofill for passwords, credit cards and login details, and single-click saving of new credentials.

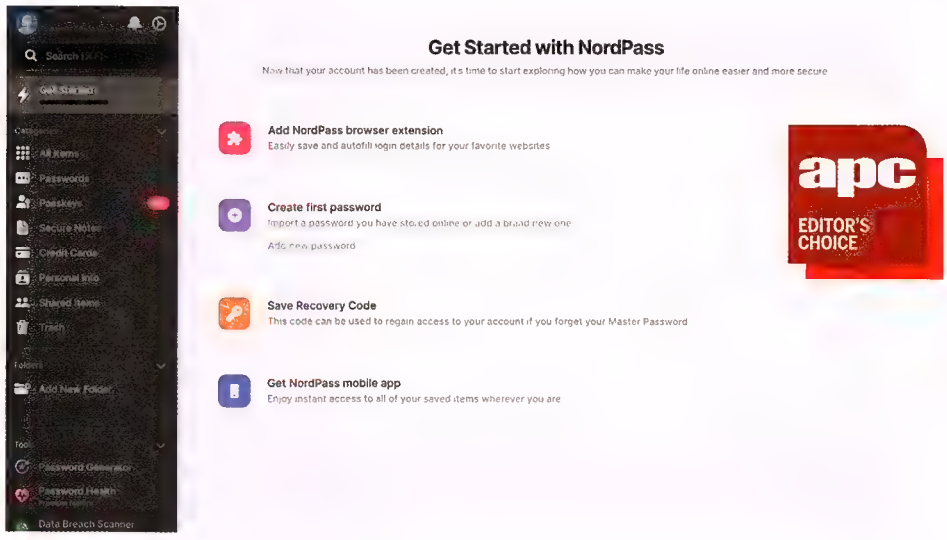
Unusually, you can even start using the service without paying a cent. Free users can store an unlimited number of passwords, and access them from anywhere, but they're only allowed one signed-in session at a time – so if you alternate between your phone and your computer, you'll have to log in again each time you change device. The free edition also won't detect weak or reused passwords, and it won't scan the web for data breaches.

A Premium account turns all of those features on for US$1.89 per month, based on an annual commitment. It also lets you allow trusted contacts to access specific credentials in case of emergencies. Sadly there's no option to bundle NordVPN into the deal – a missed opportunity in our eyes.

The Family plan, starting at US$2.89 per month, gets you six accounts, with all of the features of the Premium product. Both plans are also available as two-year commitments, so you can save a bit more money if you're willing to pay up front.

There's also a Business tier starting at US$3.59 per user per month, for up to 250 users. As well as all of the features we've mentioned above, this service includes a security dashboard, company-wide settings, Google Workplace SSO and real-time monitoring. If you want user provisioning via Active Directory, a dedicated account manager or face-to-face onboarding you'll need the Enterprise product –contact NordPass directly to get a quote.

It's very easy to get started with NordPass. There are Windows, macOS and Linux versions of the NordPass desktop client, plus mobile apps for Android and iOS; once you've installed one of these, you just need to create an account with a master password, and you're good to go. You can import existing passwords from any big-name browser, or directly from a CSV file. The only real thing missing here is the command line options you'll encounter on more techie software, such as Bitwarden.


Get Started with NordPass
Now that your account has been created, it's time to start exploring how you can make your life online easier and more secure
Add NordPass browser extension
Easily save and autofill login details for your favorite websites
Create first password
Import a password you have stored online or add a brand new one
Add new password
Save Recovery Code
This code can be used to regain access to your account if you forget your Master Password
Get NordPass mobile app
Enjoy instant access to all of your saved items wherever you are
Data Breach Scanner

Once you're in, the NordPass interface is one of the most polished password manager experiences we've seen. It does a great job of hiding away in the background and only popping up discreetly when needed. Native extensions for Chrome, Edge, Firefox, Safari, Opera and Brave take care of automatically pasting passwords into your chosen browser, and we like the way you can switch seamlessly between different NordPass accounts, to help manage your work and personal life separately.

At the bottom-right of the app you'll find a few extra features, including a customisable password generator, a password health assessment module and a data breach scanner. For ease of management you can sort your credentials into separate categories, such as social media, online shopping and banking. There's a dedicated area for payment details, too, though it would be nice to see a similar section for documents such as driving licences and passports.

A final notable feature of NordPass is its support for passkeys. These are saved in a separate location from regular passwords, and chances are you'll still have a vault full of passwords for a long time to come, but it's great to have the option of embracing passkeys as soon as your sites and services are ready.

Can you trust NordPass' security? Well, as you'd expect from a VPN developer, NordPass operates on a zero-knowledge model, with end-to-end encryption for your passwords and data syncing – so not even the NordPass team can see your data, Credentials are protected with the XChaCha20 encryption algorithm, which is also a favourite of companies such as Google and Cloudflare. And on the client side, biometric security can be added where supported by the device. Two-factor authentication is also supported for your NordPass account, optionally using an OTP generator or USB flash drive.

One area where NordPass doesn't quite excel is customer support: you get round-the-clock email support, but there's no way to call directly, and live chat agents can only help with sales questions, not technical queries.

Overall, though, NordPass is a great choice for individuals and SMBs, with a clean design, plenty of useful features and strong security. It lacks a few advanced tools such as Wi-Fi syncing, but unless you're looking for a password manager with every possible feature, that shouldn't put you off – for most people NordPass will do a great, hassle-free job.

VERDICT

★★★★½

Individual, free | bitwarden.com

Bitwarden

This open-source tool is highly secure and packed with features – and, best of all, it's free for everyday use.

Bitwarden is unlike any other password manager on test this month: it's offered under an open-source licence, which means anyone can review, access and contribute to its code. While most of us may be happy to leave that to developers, it's a reassuring degree of transparency.

What's more, like most open-source projects, Bitwarden can be used completely free of charge. And this isn't a strictly limited service like other password managers offer, either: free users can store as many passwords as they like, and sync them across any number of devices. You can even share passwords with other Bitwarden users, and make use of a built-in password generator and email aliases.

If you want more, the paid-for Premium plan adds advanced 2FA, emergency access, security reporting and priority customer support – and at US$10 a year it's still far cheaper than rival services.

There's also a family plan, which costsUS$40 per year and allows unlimited sharing and collections for up to six users, with improved storage organisation, which makes it easier to manage all of the passwords associated with busy households.

Finally, Bitwarden offers two corporate plans. A Bitwarden Teams subscription costs US$3 per user per month and adds numerous business-friendly features such as user groups, API access, unlimited sharing and better logging. Or, for US$5 per user per month, the Enterprise plan adds custom roles, SSO integration, extra administrative features and extensive self-hosting options.

Getting started with Bitwarden could hardly be simpler. Don't be put off by the fact that it's open source: you just need to download and install the app, as you would with any password manager, then set up an account and master password.

Platform support is superb: there are desktop clients for Windows, macOS and Linux, with browser extensions for Chrome, Edge, Firefox and Safari, plus more obscure options such as Brave, Opera, Vivaldi and even the Tor Browser. For mobile users, there are dedicated apps for both Android and iOS, the latter of which partners with a watchOS app for even more convenience. And if you don't have access to the app at all, you can log into your password vault and access all of Bitwarden's features via a secure web interface.

Not that you'll often need to interact directly with the app. Most of the time you can just let Bitwarden automatically save your passwords as you enter them into the browser, and then automatically refill them the next time you visit the relevant sites. The web extension even includes a built-in password generator.

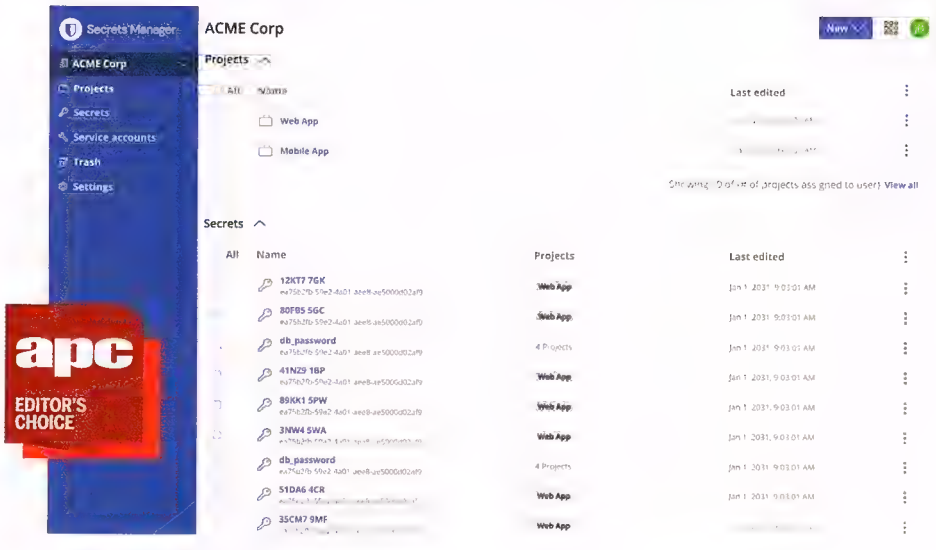
However, if you want to delve in more deeply, the straightforward app interface allows you to quickly access and edit your passwords and secure data. Manually adding a new item is as easy as filling in a simple form, and you can attach notes and custom fields to each entry. The app also tests your passwords for strength levels and, like many other apps, it monitors your password vault and lets you know if your information has been exposed in a security breach. It's not as slick-looking as some other tools, but it works just as well.

One of the few features that Bitwarden notably lacks is identity-theft protection. Pay the extra for rival Dashlane and you'll get credit monitoring, identity restoration support and insurance up to the value of $1 million. There's nothing like that here.

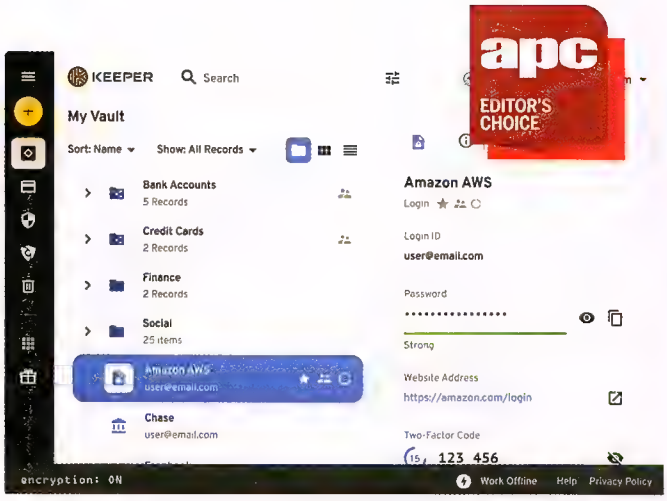
The other thing that's currently missing from Bitwarden is passkey support, but the developer assures us that this is coming very soon. Users will shortly be able to set up a passkey for their Bitwarden account, to skip entering the master password, while third-party passkeys can be added to your vault for instant logins.

As for security, your Bitwarden vault is secured with AES-256 encryption and the master password is never sent to Bitwarden, so there's no chance of a breach from Bitwarden's side of things. And while open-source software is sometimes associated with dodgy support, Bitwarden has an active online community, plus extensive tutorials, a knowledge base and forums. You can even email the developers for direct assistance. The only thing lacking here is phone support – that would have been a welcome addition, especially for business customers.

Still, there's plenty to like about Bitwarden. It has rock-solid security credentials, it works with virtually every device and browser you could think of, and it ticks almost every box in terms of features. More to the point, it's fantastic value, whether you go for the free service or the very reasonably priced paid options.



VERDICT



Keeper

Business, from $4.58 per user per month | keepersecurity.com

Security is job one at Keeper. The company undergoes regular auditing to ensure its zero-knowledge security model is strictly observed, and that it complies with US and EU data-protection directives. Its software also offers powerful admin tools, so it's a good option for SMBs.

The Keeper Business plan costs $5.96 per user per month and offers user management and extensive policy enforcement. For smaller companies the Business Starter plan costs $3.48 per user per month for teams of between five and ten, while Enterprise plans add SSO, team management and advanced provisioning.

Keeper isn't just for businesses, though. The Personal plan costs $4.58 a month, allowing an individual to store unlimited passwords and access them from an unlimited number of devices. There's no free option, but students can get 50% off Keeper, while military and medical professionals get a 30% discount.

Keeper is easy to deploy: you can use the regular graphical installer, or a command-line installation routine on Windows. Credentials can be easily imported, and businesses can also bulk-import users.

All the password management basics are here. You get a password generator, identity management and payment information, access to shared passwords and good support for passkeys. Both the app interface and the admin console are clear and agreeable to use, giving you a quick overview of activity and any security issues – and alongside desktop and mobile apps, Keeper can run directly in your browser.

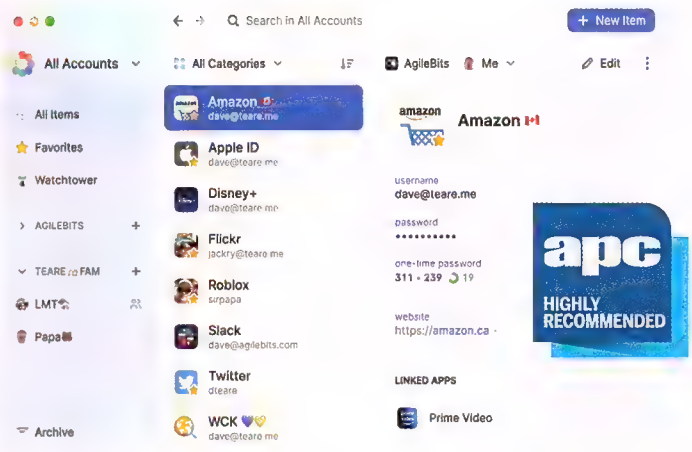
On the administrative side, users can be assigned roles and divided into teams; passwords and folders can be shared with users, teams or roles; while policies ensure everybody is using strong passwords.

Live chat support is available 24/7, which is great for businesses, while phone support is available 10am–5pm CST. Personal users don't get email or phone support, though: they need to go through the support portal or use the self-support resources on the website.

Keeper offers industry-leading security that businesses in particular will appreciate, and it starts at a good price – although its various additional features can significantly increase the yearly invoice.

VERDICT

★★★★★



1Password

US$2.99 per month | 1password.com

1Password has a top-notch business pedigree. It's also available for individuals, with subscriptions starting at US$36 a year; that includes unlimited password access, with full support for passkeys, plus 1GB of online storage and the ability to restore deleted passwords for up to a year.

For businesses, the Teams Starter Pack costs US$20 per month and covers ten users, each of whom gets 1GB of storage and unlimited shared vaults. Move up to the US$8 business plan and you'll receive VIP support, 5GB of storage per user, custom security controls and other advanced features. Large businesses can apply for a custom quote for an Enterprise subscription, which includes a dedicated account manager, setup training and an onboarding engineer.

All plans include 24/7 email support, and enable you to sync your passwords across virtually all types of device. Alongside mobile apps for iOS and Android, 1Password provides desktop apps for macOS, Windows, and Linux, plus a command-line tool and extensions for popular browsers.

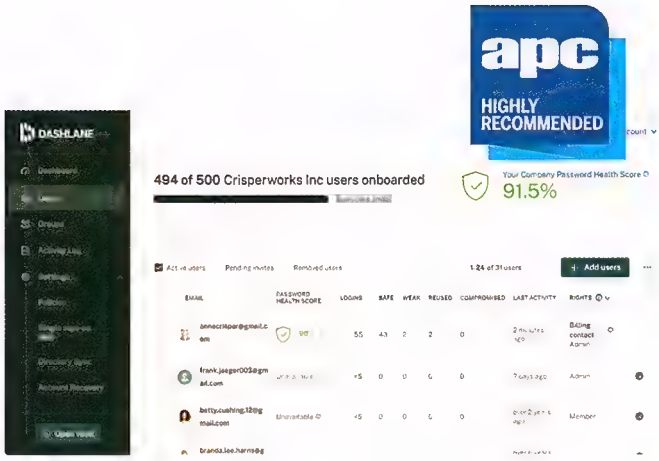
The desktop apps are quite intuitive, with a handy main view for browsing your vault and a "Watchtower" tab that tracks security breaches. Passwords can be filed under more than two dozen categories, which offer different data fields to suit the type of information you're storing. However, logging in online is more complicated than with other password managers: you still use your master password to get in, but you also need to authorise it by copying and pasting a "secret key" to verify it's you.

That reflect a general focus on security. Since your master password is never shared with 1Password or any third parties, the software prompts you during setup to create an emergency PDF with the information needed to recover your account if you get locked out – a reassuring touch. The app also supports 2FA with Authy and Microsoft Authenticator, and comes with security breach alerts, protection against keyloggers and AES 256-bit encryption.

In all, there's everything here that individuals and businesses need to safely store and share passwords and other sensitive pieces of information – and the range of pricing options means it can be a low-cost way to keep your data safe.

VERDICT

★★★★



Dashlane

Business, US$2 per user per month | dashlane.com

Dashlane boasts that more than 2.5 billion credentials have been saved on it, by customers including Wayfair and PepsiCo. You can try it yourself with the free plan, which lets you store unlimited passwords and passkeys on one device, and includes a password generator, 2FA and personal alerts.

If you want more, there's an Advanced subscription, which supports unlimited devices and adds dark web monitoring to make sure your credentials haven't leaked. The US$3.33 Premium plan includes the Hotspot Shield VPN, while the Friends & Family plan costs US$4.99 a month for up to ten users, with all Premium features plus a dashboard for easy management.

There are three business plans too: the Starter plan offers basic password functions at US$20 per month for ten seats; the Team plan adds the VPN and supports more users; and the full-fat Business plan costs US$8 per user per month and adds SSO integration, SCIM provisioning and phone support – something you don't get with many rival services.

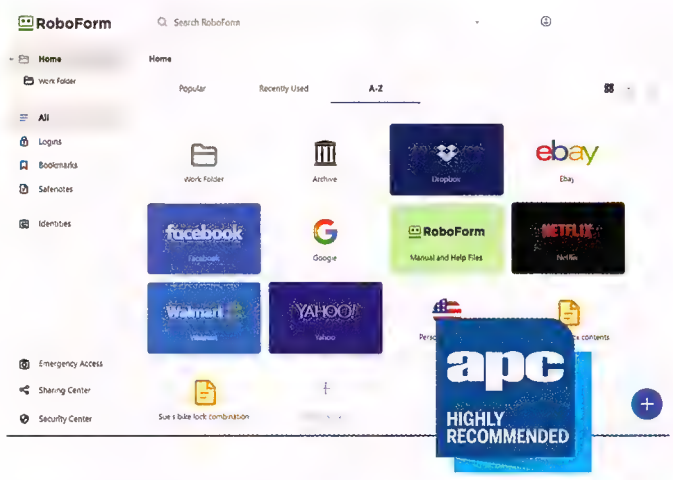
The setup process guides you effortlessly through the process of storing your first passwords via the browser extension, and once you've done this, Dashlane is beautifully easy to use. The interface is clean and logical, and you don't even have to download an app – it's all handled via browser extensions or a web interface that's packed with features. As well as passkey support and personalised security alerts, there's a bulk password-changing function, and for businesses, the software can provide bespoke security ratings for individual team members, and security policy management via the admin console.

As for security, Dashlane uses a zero-knowledge master password, and businesses can use custom policies to create a tailored secure environment. To minimise the risk of security flaws, Dashlane has a bug bounty programme with rewards of up to $5,000.

Live chat support is available in English during working hours on weekdays, but the simplicity of Dashlane's interface means even first-time users can hit the ground running. Its popularity is easy to understand, but we will say that some of Dashlane's business products are quite expensive when compared to other password manager tools.

VERDICT

★★★★



RoboForm

Business, 1-10 users, from US$3.49 per user per month | roboform.com

Originally devised as a business product, RoboForm now caters to both organisations and individuals. There's even a free personal service that lets you store any number of passwords and warns you of data breaches, but you can only use it on a single device. To fully unlock the software costs US$24 per year, or US$48 for up to five users.

For businesses, RoboForm costs a flat rate of US$40 per person per year, with discounts of 15% and 25% respectively on three- and five-year deals. The business tier includes some advanced administrator controls, such as enforced minimum master password standards and periodic password changes; businesses can also make use of public-private key cryptography, to share encrypted information with employees without exposing the contents.

RoboForm can be used via native desktop or mobile apps, using a browser extension, or directly on the RoboForm website. While the interface isn't exactly glamorous, it's easy to navigate and has all the key features, including one-click login, cross-platform password syncing and a strong password generator.

RoboForm is great when it comes to organising your information, with a flexible folder model that lets you arrange passwords in whatever way works for you. Password sharing is also handled well on the business side, enabling users to securely share credentials with other users within their company.

Another strength of RoboForm is its high degree of security and account control. Access is protected by lots of authentication options, including PINs, master passwords and biometrics, and 2FA is available on business accounts, too, with support for third-party authentication apps.

RoboForm can be comparatively expensive, especially if you want to equip a medium-sized team. For basic password management services there are plenty of cheaper solutions, including the free Bitwarden service. However, RoboForm's administrative controls and security credentials are a definite strength, making it a strong choice for companies that are willing to invest in a powerful password management solution. ■

VERDICT

★★★★

72
techradar.
The source for tech buying advice
techradar.com

Stop Wi-Fi hackers

Your home network is more vulnerable to hackers than you realise. Nik Rawlinson reveals the most effective ways to protect all the devices connected to your Wi-Fi.

WHAT YOU CAN DO

- Change the default password for accessing your router
- Upgrade your encryption to the highest level
- Stop your neighbours stealing your Wi-Fi
- Identify and block unauthorised devices
- Schedule your Wi-Fi to disconnect at night
- Update the software on your smart devices
- Isolate your PC from other Wi-Fi devices

There's something rather magical about products that 'just work'. Smart TVs, speakers with built-in voice assistants and video doorbells all fall into this category. Plug them in, connect them to your Wi-Fi, and you're ready to go. There's very little to configure and usually even less to maintain.

The trouble is that such convenience can provide a false sense of security – and that can lead to complacency. Smart devices – just like computers – are often eminently hackable and you're reliant on the manufacturer to remotely apply the necessary security patches and updates in a timely manner. If they don't, you risk hosting an unsafe device on your network, which could put other devices, including your PC, at risk.

If you don't believe us, read around. There have recently been reports of vulnerabilities in outdated Google doorbells (www.snipca.com/47425), and claims that devices from rival Ring have been accessed by hackers (www.snipca.com/47427). Researchers in Texas found a way to issue silent voice commands to smart-home devices (www.snipca.com/47428), while UK and Italian researchers managed to extract Wi-Fi passwords with the help of a smart light bulb (www.snipca.com/47429).

This means that if you're running any internet-connected 'smart' device in your home, it's essential to strengthen your defences, both through the device where possible, and on the network itself. Here we explain the most reliable ways to make your Wi-Fi unhackable.

Your smart home security questions answered

Why would anyone want to hack a smart device?

Some hackers break into devices purely for the fun of it or to prove they can do it. Similar to trainspotters collecting locomotive numbers, they want to add more and more conquests to their list. However, they're not the ones you need to worry about.

A determined intruder usually has more malicious aims. To them, an insecure device is an entry ramp to your network. Many smart-home devices run sophisticated operating systems – often a version of Linux – designed to perform a specific range of functions. They may also contain a small amount of unused onboard storage.

When a hacker detects a vulnerable device, they can use that storage and the operating system's dormant features to execute their own code. And, because the same smart devices are in millions of homes worldwide, the hacker can apply what they've learned about the vulnerabilities of one device to any other they come across, quickly building up a network of compromised gadgets under their control.

How do hackers find an insecure device?

Think of your router as a block of flats with a purely numerical street address (technically known as its IP address). The building contains several ports – front doors in our analogy – behind which live your devices, and through which they send and receive data.

In much the same way as real-world burglars might drive by your home, hackers can trawl the internet using IP-address scanners (as pictured above right). When they find an address hosting a network, they work their way through every port until they find one that's open. If a vulnerable smart device lives behind that port, they'll be able to repeat a hacking routine they've performed many times elsewhere to infiltrate your gadget and reprogram it to do whatever they choose.

While it may appear to be functioning normally, your compromised smart device could then create serious problems – and start sending the hacker your passwords and payment-card details; help compile a pattern of movements that indicate when your home is unoccupied; or attack other devices on your network.

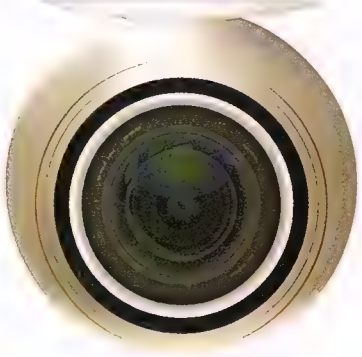
Hackers scan IP addresses across the world to find open ports to exploit.

So as long as my router is secure, aren't I protected?

Keeping your router's firmware updated helps, but it's not the only thing you need to worry about. Smart devices spend all day communicating with remote servers through authorised ports. Unless your router is inspecting the data that's passing through it, working out where it's heading and whether that's what you intended (which would be a huge and impractical task) it's got no way of knowing that it's acting as a conduit for stolen data.

Does my risk increase with the number of devices?

Not necessarily. You could add 1,000 video doorbells, internet-connected printers or TV streaming sticks to your network and – if they all come from reputable brands – you're very unlikely to introduce a vulnerability. Or, you could add a single Wi-Fi camera from an unknown manufacturer (like the one pictured below), or a second-hand device that's been maliciously reprogrammed, and your network will be exploited within an hour.



A single vulnerable Wi-Fi camera could compromise your entire network.

What kind of devices should I be worried about?

Anything that has access to the internet. However, while it's a good idea to be cautious when adding any device to your network, you should be more wary of less familiar brands. If a device from a big-name brand was ever found to be insecure, it would be headline news, could damage the company's sales and tarnish its reputation beyond repair. In short, big brands have more to lose.

Considering the cost of developing, manufacturing and marketing a smart product that nobody else sells, that's something they'd try to avoid by making sure their devices are as secure as possible, and that they stay that way through frequent updates.

Do smart devices get less secure as they age?

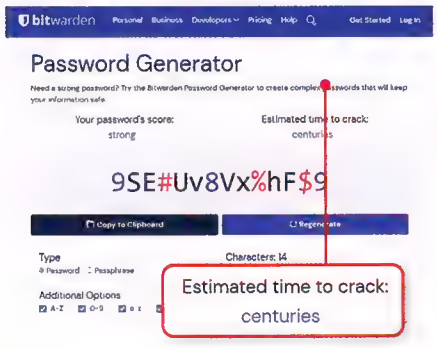
That can happen. Security measures in the past were certainly less foolproof. A few years ago, we might have suggested swapping letters for numbers to beef up your password security – so, 'pa55word' rather than 'password'. Bots got wise to that trick, so we advised throwing in capital letters, then a few years later, adding special characters and punctuation.

Today, we recommend using a password manager such as Bitwarden (**www.snipca.com/47395**) to generate strong passwords, though many security experts believe it's time to move beyond passwords altogether.

Network security standards have also

changed. WEP (Wired Equivalent Privacy), introduced in 1997, was once considered state of the art when it came to securing a wireless network. Then, in 2005, the FBI demonstrated that it could be cracked in less than three minutes using publicly available tools.

WEP was replaced by WPA (Wi-Fi Protected Access), and WPA by WPA2, then WPA3. So, if your smart device is still using outdated security protocols, it will be less secure today than it was when you bought it because it hasn't kept up with these technological advances.



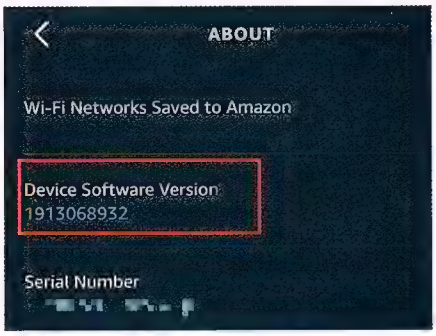
Bitwarden generates secure passwords that will take centuries to crack.

So, do I need to update my smart devices' software?

If you can, you should, although it's not always necessary. For example, many smart devices, including Amazon's Echo speakers and Fire TV Sticks, update themselves automatically. If you have an Echo speaker, you can check that you're using the most recent firmware in the Alexa app. Tap Devices on the toolbar, followed by 'Echo & Alexa', then the device you want to check. Tap Status, then scroll to the bottom of the screen and tap About. Compare the number below Device Software Version (see screenshot above right) against the list at **www.snipca.com/47329**.

If you have a Fire TV device, use your remote control to select Settings, then My Fire TV. Click 'About', then check the number below Software Version and compare it to the latest release for your device at **www.snipca.com/47328**.

The steps you need to take will depend on the device. Start by logging in using the device's address on your network, and the administrator username and password. If you haven't changed these, they'll often be shown on a sticker on the device itself. Click through the dashboard until you find an option to update the software, then check the manufacturer's website for the latest release. Make sure you keep the device connected to your network and the mains throughout, as a failed update can make the device unusable.



Check the software version of your Echo speaker in the Alexa app.

Wi-Fi security settings you must change

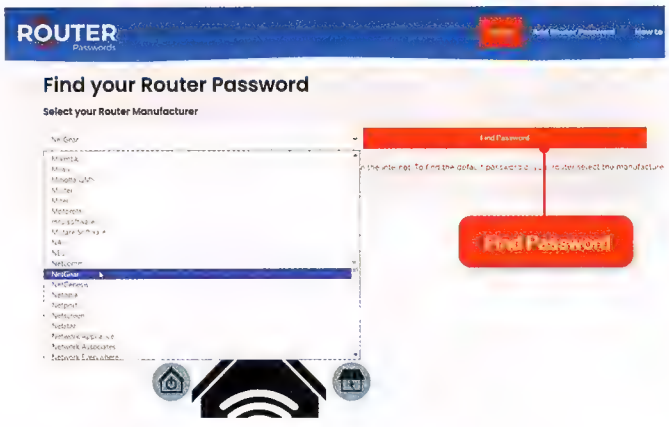
Change your default passwords

Almost every Wi-Fi router comes with a default username and password. Recently, manufacturers have become better at setting these as random words or strings of letters rather than the much less secure 'admin' and 'password' of old. As we mention in the box opposite, you can find details for most routers at **www.routerpasswords.com** (see screenshot below).

However, it still makes sense to reset any default to something different to prevent hackers from being able to access your network through your router's settings.

You can change your router's administrator password through its browser-based control panel. Note that this is the password used to access the control panel itself, and not to log on to your Wi-Fi. If you want to change the Wi-Fi password as well, this is also done via the control panel, but will need to be managed separately.

If you're changing the administrator login password, consider writing it on a label and sticking it to the router itself. While we would not usually recommend writing down a password, it is common practice for routers to have their login passwords attached to them when they come from the factory, so this is only sticking with convention.



Find the default password for your router at Router Passwords.

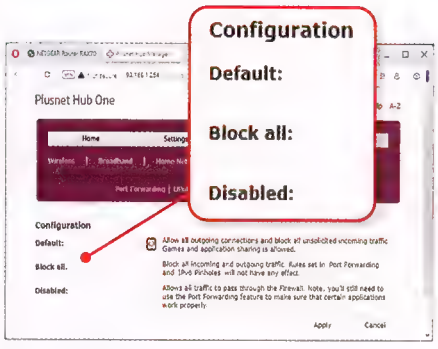
Few smart devices have passwords that you need to type in yourself. They are usually managed using apps on your mobile phone and, as long as nobody else has your phone, that should keep them safely out of reach.

However, some log into online accounts to perform specific functions, such as Wi-Fi-enabled thermostats that manage your boiler, or security cameras that upload footage to online storage. You will usually be prompted to provide your own password when setting up these kinds of online accounts rather than being given a default password.

It still makes sense to change the password every so often, though – particularly if news breaks of a data breach or leak from the service in question. The exact process for doing this varies by product, but start by checking any associated app and, if that doesn't include a relevant option, try logging into the service through your browser.

Turn on your router's firewall

Turning on your router's built-in firewall lets you block internet traffic, whether incoming or outgoing, through specific ports – or entirely. By limiting the number of routes through which data can travel, you also limit the number of



Enabling your router's built-in firewall will help block unwanted traffic.

opportunities hackers and compromised smart devices have for accessing and transmitting your personal information.

You may have come across the Windows Firewall – most likely when it popped up an alert and asked you to authorise (or deny) a particular action, but the firewall built into your router won't display these alerts because it will make those decisions based on rules you set.

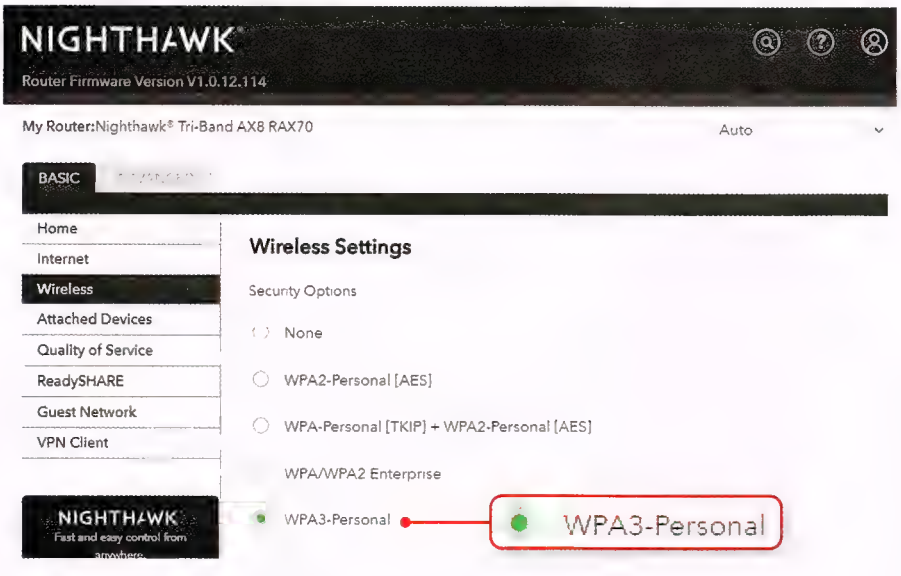
At its most basic, your router's firewall will have options like the three in our screenshot above, where the default is to block all unsolicited incoming traffic, but allow outbound traffic. However, other options on this router also allow us to authorise specific traffic types, such as data for bespoke games, mail servers and video-chat services. In most cases you won't need to make any such adjustments, which makes enabling the firewall as close to a one-click security measure as it's possible to get.

Update your Wi-Fi encryption

You should always use the most recent encryption supported by your router. Ideally, this will be WPA3, but as this is relatively new your router might not support it – especially if it's an Internet Service Provider (ISP)-supplied device you received on signing up many years in the past.

If your router doesn't support WPA3, opt for WPA2 Personal if your router offers that, or WPA2-AES as a stopgap, but bear in mind that because this encryption technology has been previously compromised, it doesn't give you complete protection.

There are two different kinds of WPA3 encryption – Personal and Enterprise. As its name suggests, Personal is the best for home use, so if your router offers both options, choose this one (see screenshot below).



If your router supports the latest WPA3 encryption, use it to secure your network.

ACCESS YOUR ROUTER'S CONTROL PANEL

Many of the tips in this feature require access to your router's control panel. This can be accessed in a browser on any computer connected to the router itself, wirelessly or via an Ethernet cable. Manufacturers commonly use the IP addresses 192.168.1.1, 192.168.0.1, 192.168.1.254 or 10.0.0.1, but, to save you trying them all, you can look up the address you need using Windows.

Type cmd into the Windows search box and press Enter to open a new Command Prompt window. When it appears, type ipconfig and press Enter, then look for the block of four numbers beside or below Default Gateway. Typing this into your browser will bring up your router's control panel.

In our screenshot you can see our router's address – 10.0.0.1 – is shown beside Default Gateway.

Check your router's label or manual for the username and password you need to log into its control panel. If you can't find these details, search for your device at **www.routerpasswords.com**.

This TP-Link router has WPA3 encryption to keep your network ultra-secure.

Ditch your ISP router

If your ISP-provided modem-router doesn't support WPA3, we'd advise buying a new router to boost your security. You can buy a WPA3 router with the latest security protocols for around $110, such as this TP-Link AX1500 model from Amazon, pictured above), which should help keep your network and devices safe.

It's unlikely your ISP will agree to send you a new router for free if your existing modem-router combo still works. So, if you do buy a new WPA3 router, connect this to your ISP device using one of its Ethernet ports. Next, turn off the wireless networking features of your ISP's device so it's just acting as a modem, and use the new router to broadcast a better protected wireless network around your home.

Block intruders from your Wi-Fi

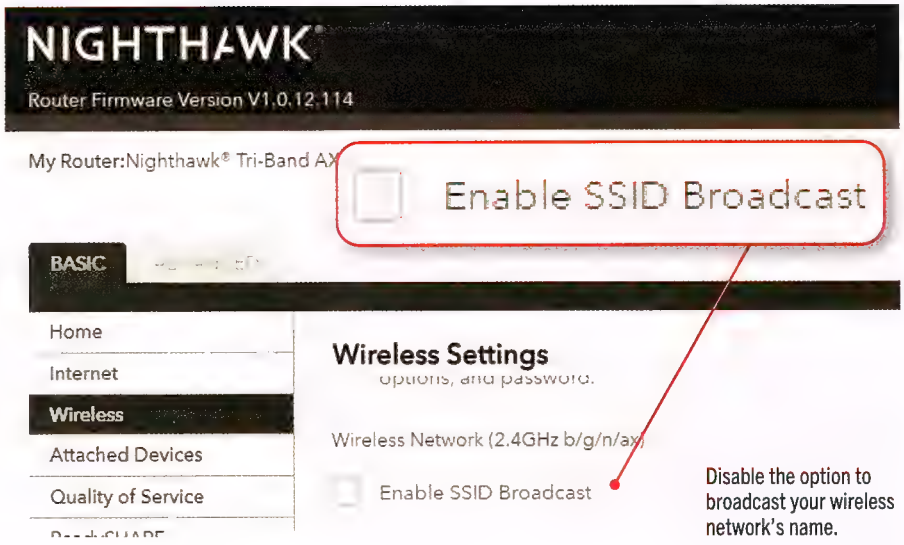
Keep your neighbours off your Wi-Fi

Wireless networks are usually set to broadcast their name so they're easy to find and connect to. This name is known as the SSID – or Service Set Identifier – and it's what you click when you choose a specific network from the Windows taskbar or in the list of networks on your phone or tablet.

However, this convenience is only a good thing if you also use a strong password. If you use something that's easy to guess, like the name of a pet, anyone who knows a little about you and lives within range of your signal could easily find their way on to your network. Once there, they could exceed any cap you have on your broadband data allowance, or connect insecure devices over which you have no control. All of which would undo the good work you've done in securing your network and devices.

If you suspect your neighbour is piggybacking your network, first hide your SSID by turning off the option to 'broadcast' this in the router's browser-based control panel (see screenshot right).

Now, change the SSID to something you've not used before, and choose a new password. As the SSID is now hidden, anyone who wants to connect will need to already know both the network name and your password, which effectively doubles your security.



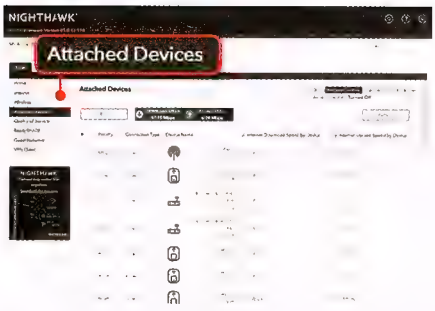
Disable the option to broadcast your wireless network's name.

It therefore makes sense to choose something quite complex for the network name. Ideally, it shouldn't be difficult for you to remember, but it should be very tricky for someone to guess.

You'll now need to reconnect your devices to your network, as they no longer recognise its name and can't see the SSID. To connect a Windows 11 computer, click the Wi-Fi symbol on the taskbar, then the right half of the split Wi-Fi button. Click 'Hidden network' in the list of networks, then enter the SSID and password. If you're using Windows 10, click the Wi-Fi icon on the taskbar, followed by Hidden Network. To reconnect your smart devices, use their associated apps on your phone.

Block unauthorised devices on your network

Routers need to keep track of the devices – technically known as 'clients' – that



Your router monitors all the devices it's serving and lets you block intruders.

connect to them, so they know where to direct the data they receive. As such, they can draw up a list of connections you can scan for any unfamiliar entries. After logging into your router's control panel, look for an option for DHCP client list, attached devices or similar.

It's often possible to temporarily block a device from the client list, so, if you spot something suspicious, block it, then make sure all of your computers, and smart devices – such as video doorbells, speakers and streaming sticks – still work. If something no longer functions as expected, it's probably the device you blocked, so unblock it.

To ban devices on a more permanent basis, it's usually possible to block their MAC (Media Access Control) address , rather than their IP address (see box, right). The MAC address is a unique string of letters and numbers, organised in pairs, that's used to identify the networking circuitry inside the device. So, while your computer will technically have a MAC address, it's not assigned to your computer so much as it is to its network card.

Click a client in the list of attached devices to see whether your router reveals more details. If it does, and these details include the MAC address, select and copy it. Next, look for an access control option and, if this reproduces the list of clients you were just looking at, use the tick boxes that it displays to block the unauthorised device. If you need to manually enter the MAC address of a device you want to block, paste in the address you just copied.

Knowledge Hub
ExpressVPN for routers FAQs
Need a VPN for your router?
Get ExpressVPN Now
Need a VPN for your router?
To set up ExpressVPN on your router, refer to the corresponding guide for your

Install ExpressVPN on your router to protect all your connected devices.

Hide your entire network behind a VPN

One of the most effective ways to secure the data your PC sends over the internet is to use a VPN. Any VPN tool running on your computer encrypts the data before transmitting it, and doesn't decrypt it until it reaches its destination. That way, if anything or anyone is snooping on your connection, all they will see is scrambled gobbledegook.

You can also run a VPN on your tablet or phone but – because you're not usually able to install software on them – you won't be able to use a VPN on a smart device such as a speaker with a built-in voice assistant, a video doorbell or a smart camera.

Depending on your router, you may be able to get around this limitation by signing up with a VPN provider and entering your login credentials through the router itself. This allows the router to encrypt all of your internet traffic, whichever device it originates from and saves you having to install VPN software on every PC, tablet or phone on your network.

Most of the best paid-for VPNs can be installed on your router, including ExpressVPN (**www.snipca.com/47418**, pictured below left) and NordVPN (**www.snipca.com/47419**). Free VPNs, which have limited bandwidth, don't generally offer this option.

If you do go down this route, obviously remember that when you're not online via your home network, your traffic won't be processed by the VPN, so it won't be encrypted. This is something to bear in mind if you use your tablet or phone during your commute, or connect to a coffee shop's Wi-Fi from your laptop.

Schedule your Wi-Fi to disconnect at night

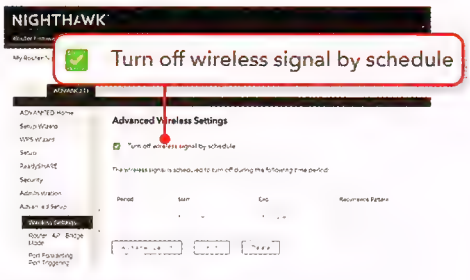
As well as hiding your router's SSID and changing your Wi-Fi password, you can switch off your network when it's not needed. That way, any devices connected to it will be immediately disconnected, and they'll be safely out of the reach of hackers. Plus, your neighbours won't be able to piggyback your connection while you're asleep.

There are several ways to do this. Two physical options are to switch off the router at the wall, or use a timer plug. However, we wouldn't recommend regularly disconnecting your broadband.

WHY NOT BLOCK AN IP ADDRESS INSTEAD?

The reason for blocking on the basis of a MAC address rather than an IP address, which is the address given to each device by the router, is that IP addresses can change over time. So, while an unauthorised device might be at 192.168.1.50 one day, it could be at 192.168.1.44 the next.

You therefore can't actually 'block' an IP address in this respect: you can only tell the router not to allocate it to any device in the futur. This does nothing to prevent interlopers from continuing to access your network using a different IP address.



Turning off your Wi-Fi overnight protects all your connected devices.

That's because internet providers monitor the connections between customers and their servers, and use a technology called Dynamic Line Management – or DLM – to tweak each line's individual settings to maintain a stable connection. If you regularly turn off the router, DLM might interpret this as instability on the line and reduce the speed of your connection in an effort to improve overall performance.

Turning off just the Wi-Fi while leaving the router on and connected gets around this problem while still allowing you to shut down the network at night. If your router supports this scheduling option, you'll find it in the browser-based control panel (see screenshot above).

Be aware that some smart devices may try and call home in the small hours for software updates, which they won't be able to do if they don't have a physical connection to your router (which will still work even when Wi-Fi is turned off).

Secure your smart devices

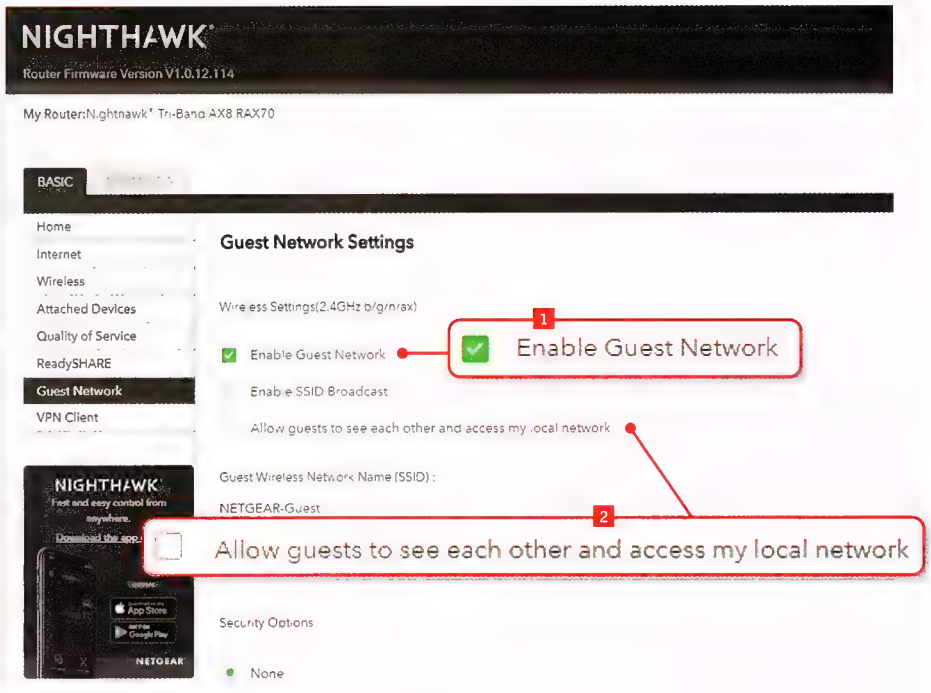
Update your smart devices' software

Smart TVs and voice assistants have operating systems that let you interact with them directly. Other smart devices, including plugs, Wi-Fi-connected light bulbs and security cameras, have what's known as firmware. This is software you can't interact with directly, but which is used to manage and provide their core services and functions.

Manufacturers update both operating systems and firmware over time and when vulnerabilities come to light, so it's important to ensure you're always running the most recent release on every device.

In many cases, they will update themselves – often overnight when not in use – so all you need to do is check that they're up to date. You usually can do this on your smart TV by going into the About section of its settings and selecting 'Software update' or similar (see screenshot below). For devices without a screen, you can update the software through the associated app.

If there's no way to manually update a device and it's not running the latest software, check with the manufacturer as to why this might be. If they've stopped supporting a device, it's time to think about replacing it, because running outdated firmware on one device can put other devices on your network at risk.



Host smart devices on a guest network to keep them safe.

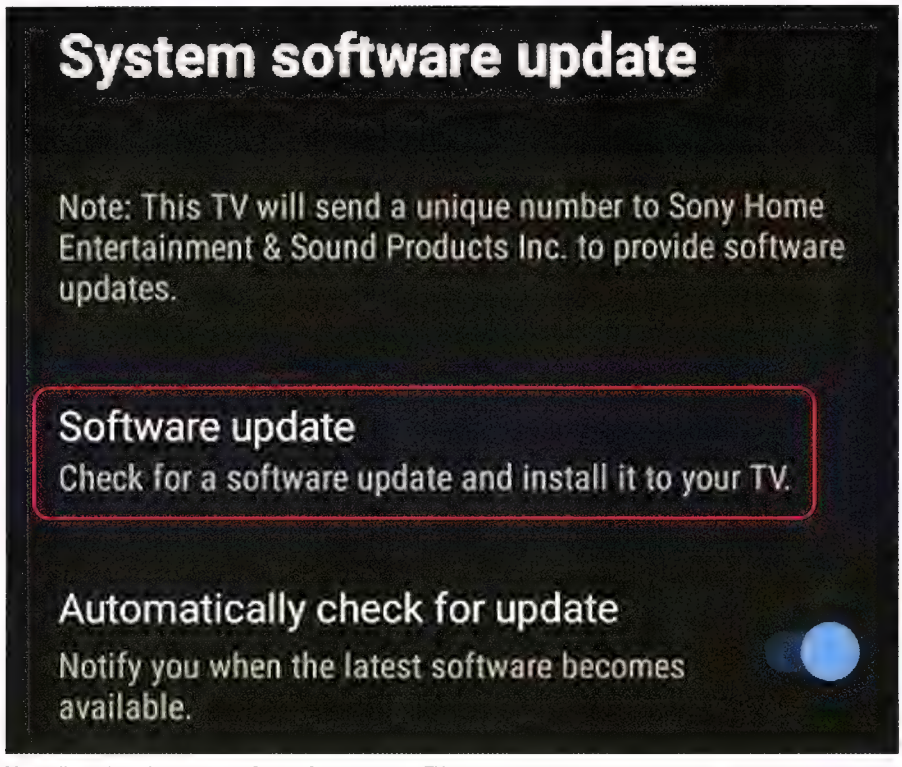
Isolate smart devices on a guest network

From smart TVs and speakers to laptops and desktop PCs, you probably have lots of devices on your network and, if just one of them is vulnerable to attack, it could provide a point of entry for hackers who want to steal data from your PC, or encrypt it and demand a ransom to unlock it.

One of the most effective ways to mitigate this is to keep all your smart devices on a separate network from your main computer. That way, if one of them is compromised, your PC should remain out of reach.

In most cases, you won't need to set up a second router to host a separate network, as most routers – even those supplied by ISPs – let you set up what's known as a guest network. While this has access to the internet, just like your regular network, it's isolated from your primary network.

Enabling a guest network is usually a one-click operation in the router's browser-based control panel (1 in our screenshot above). If you also have an option to allow guests to access your local network, make sure this is disabled 2.


System software update
Note: This TV will send a unique number to Sony Home Entertainment & Sound Products Inc. to provide software updates.
Software update
Check for a software update and install it to your TV.
Automatically check for update
Notify you when the latest software becomes available.

Manually update the system software for your smart TV.

Stop snoopers watching your CCTV

Security cameras can be the most revealing of all smart devices if a hacker gains access to them. Not only could the hacker be watching you going about your daily business, but they could also build up a detailed record of your movements, so they know when the house is likely to be empty.

Store data from your smart doorbell locally using the Blink Add-on.

The usual advice about changing any default passwords naturally applies here, but if you also have the option of applying two-factor authentication (2FA) you should enable it. 2FA keeps a record of authorised devices and, when an unfamiliar device tries to connect, it requests a code, either from a pre-authorised authenticator app, or by sending the code via a text message to a pre-registered phone number for you to type in.

If the hacker doesn't have access to your authenticator app and they have no way of accessing your messages, this will go a long way towards keeping their eyes off your camera feed.

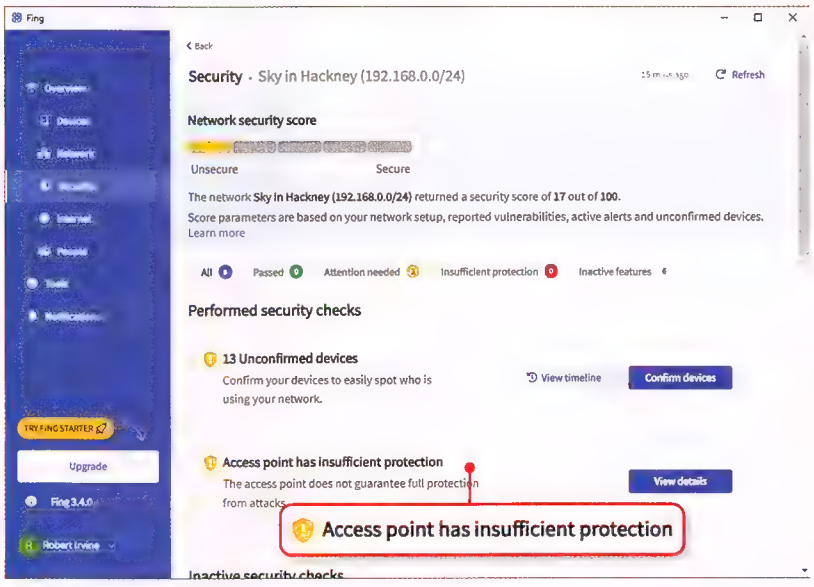
Secure your smart doorbell data

Uploading videos from your smart doorbell to online storage is convenient, but it costs money and sends the data outside your home, which is an obvious security risk. If you prefer to keep the data local, choose a system that comes with its own storage.

Amazon's Blink Video Doorbell (**www.snipca.com/47400**) and Blink cameras can save data to the company's Blink Add-On Sync Module 2 (**www.snipca.com/47401**, pictured above), which costs $51 when bought on its own but is bundled with some multi-camera packs.

This module has a USB port to which you can attach a USB stick. We're using a Sandisk Ultra Fit drive (**www.snipca.com/47402**) with ours because it's about the size of a thumbnail, so doesn't protrude far when plugged in.

The bonus of saving video locally is not only that it doesn't leave our home, but we also don't need to pay an ongoing subscription for cloud storage.



SCAN YOUR WI-FI NETWORK FOR VULNERABILITIES

Securing your Wi-Fi using the advice we've provided will protect your devices against hackers, but it's important to check your network isn't already compromised. Annoyingly, our favourite free network scanners, F-Secure Router Checker and Bitdefender Home Scanner, are now only available as part of the companies' paid-for security suites.

The best alternative we've found is Fing Desktop (**www.snipca.com/47422**), which scans your network for connected devices and prompts you to confirm those you recognise. It also checks that your router is sufficiently protected against attacks (see screenshot), by identifying weak encryption.

For automatic network monitoring, security alerts and fixing of router vulnerabilities, you need to upgrade to one of Fing's paid-for versions. It recently launched a new 'intermediate' price plan, Fing Starter, which costs $3 a month or $25 a year (**www.snipca.com/47423**). For total peace of mind about your Wi-Fi security, that's not bad value.

Stop your smart speaker saving your voice

Smart speakers are listening all the time. If they weren't, they wouldn't be able to detect their 'wake word'. However, you can check what your speaker has heard, and limit what it records.

If you have an Echo device, open the Alexa app on your phone and tap More followed by Settings. Select 'Alexa Privacy', then Review Voice History. By default, the app will show you all the audio captured over the previous 24 hours, but you can change this by tapping Displaying, then choosing options from the 'Filter by date' and 'Filter by device or profile' menus.

If you only want to delete one or two specific recordings, select them in the list and tap the 'Delete recording' button. If you want to delete everything, select All History in the 'Filter by date' menu, then tap 'Delete all of my recordings'.

To save time, you can enable this feature by voice. Return to the Alexa Privacy screen and tap Manage Your Alexa Data. Switch on 'Enable deletion by voice' (see screenshot right) and you can use commands such as: 'Alexa, delete everything I said today'.

You can also decide how long Alexa should keep recordings. Tap 'Choose how long to save recordings' and select one of the options, which range from keeping them until you manually delete them to not saving recordings at all.

If you have a smart speaker with Google Assistant built in, voice-activated deletion is already enabled. Say "Hey, Google, delete today's activity" to delete what you've said in the last 24 hours. Change this to 'this week's activity' to wipe the previous seven days.

You can also browse and delete your recordings by visiting the Google Assistant activity page in your browser (**www.snipca.com/47399**). ■

Part 1 of 8: Line by Line

A Vision to Behold: The Story of Electronic Displays

In this new multi-part series, Darren Yates re-traces the history of electronic vision and the many incredible technological advances that have shaped the world we see over the last 100 years.

No electronic device has changed our view of the world we live in quite like the electronic screen. Whether it's a cathode-ray tube television from 1956 or a smartphone purchased ten minutes ago, our lives have been dominated by the desire to see beyond what is in front of us. For nearly a century, the world of electrical engineering has delivered an increasingly vast array of devices to help us see, whether beyond the horizon or beyond our imaginations. Over the coming months, we'll re-trace a history of electronic vision, looking at the technologies, the people and how they shaped events in Australia, the world and beyond. This month, we begin back in the 1920s, with a Scottish inventor and an Idaho farm-boy each separately dreaming of moving pictures by radio-waves – and the little-known Australian engineer who beat them all to invent television some 40 years earlier.

Tea chest and sealing wax

Today, they're known as the 'Roaring Twenties' and while it was the decade desperate to forget the horrors of a 'war to end all wars', it was also a decade eager to forge the new 'electronics' age. By the 1920s, the electronic valve had created the world of 'wireless' (what we now call 'radio') and as Sydney-siders began tuning into new local radio-station 2SB (today, ABC Radio Sydney) in late-1923, the 'triode' valve was making possible ground-breaking new experiments around the world.

Scottish electrical engineer John Logie Baird was something of a serial entrepreneur, having launched numerous businesses, including selling socks. However, it was in 1923 that Baird began experimenting with idea of television, re-working ideas dating back well into the previous century and initially using little more than the household items he had on hand, including an old tea chest.

The pioneering 19th century

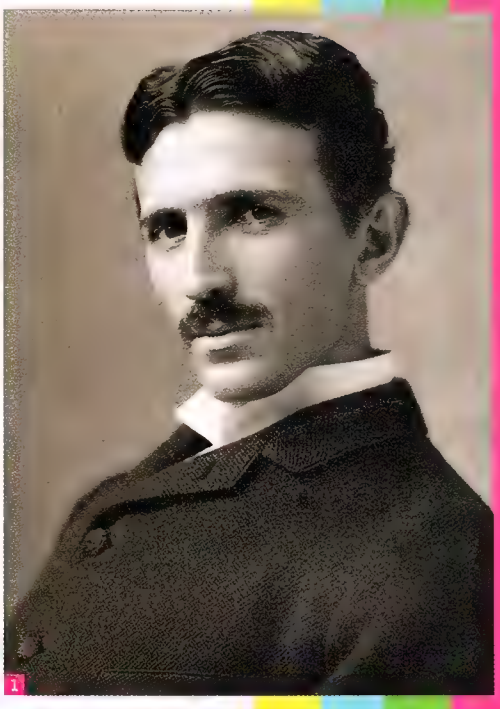
Many world-changing technology inventions are the result of decades – sometimes centuries – of work, building upon foundational ideas to create something new and television was no different. In fact, our technological world today owes its existence to those foundations laid during the 1800s by such scientific royalty as Nikola Tesla, Michael Faraday and James Maxwell to name just a few.

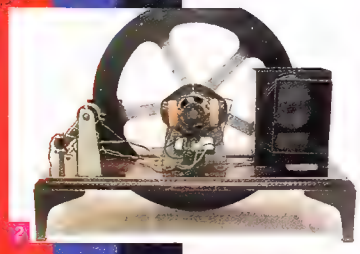
However, the realisation of television relied on a number of key events throughout the 19th century.

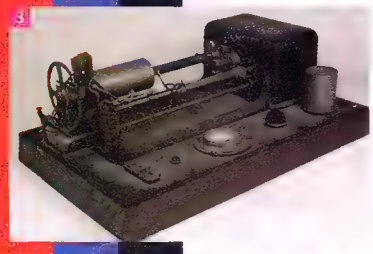
The invention of the electric telegraph in 1837 was the first practical application of data transmission over wire, independently created by English scientists William Cooke and Charles Wheatstone, as well as by the American inventor Samuel Morse. However, it was Morse and his 'code', a scheme whereby letters of the alphabet could be digitised and transmitted as a series of 'dots' and 'dashes', that showed information could travel vast distances in minimal time.

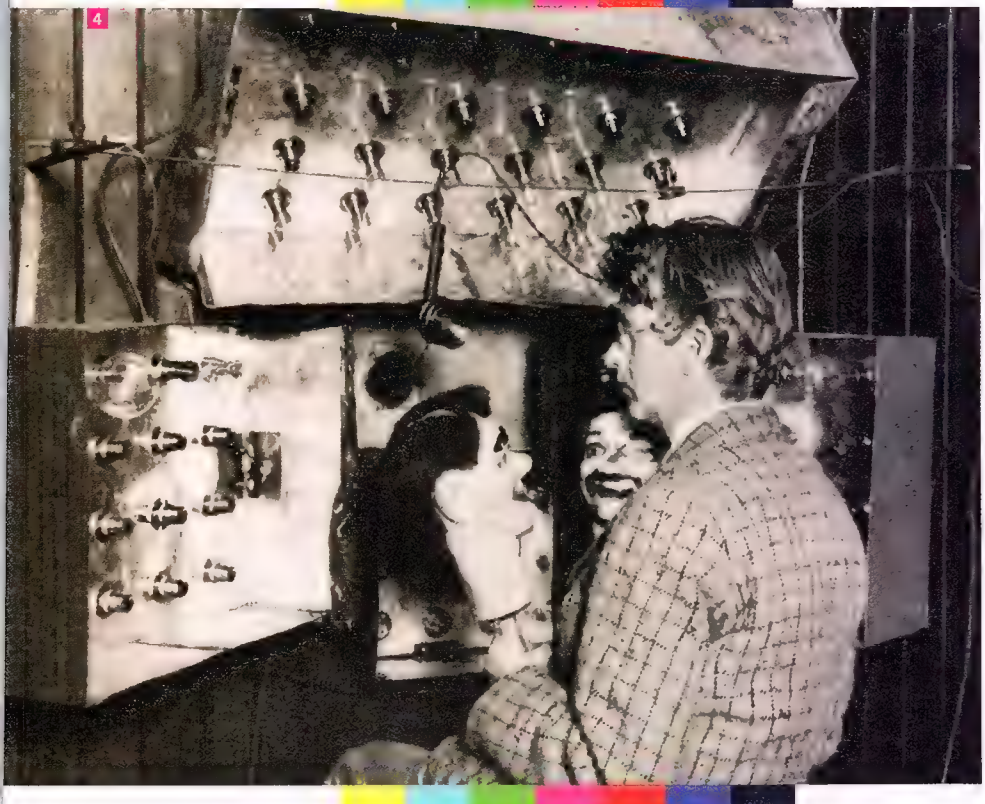
Just a few years later in 1843, Alexander Bain, a Scottish engineer, conceived an idea that would dissect or 'scan' an image into an electrical voltage stream, transmit it via telegraph and recreate the image at the receiving end. Many of us would now recognise his idea simply as the 'fax machine'.

Willoughby Smith isn't a household









1 Nikola Tesla, a pioneer in AC power, met Henry Sutton in London in 1892 (Public Domain)
2 Inside the 1930 Baird Televisor with its Nipkow Disk (Image credit: Catalogo Collezioni, Museoscienza.org. CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=48924969).environments.
3 The Fultograph was the first radio-fax machine in 1929 and tested at radio stations 2UE (Sydney) and 3DB (Melbourne) (Image credit: Museums Victoria, CC BY 4.0)
4 John Logie Baird developed the first consumer television in 1929 (Public Domain)

name either, but in 1866, he discovered an unexpected property of the semiconductor element, Selenium – namely, that its electrical resistance varied notably to the presence of light. Smith didn't know it at the time, but his find would lead to the Selenium photocell, a vital component in early television (and launch the science of 'optoelectronics').

However, as innovative as Bain's photo-telegraphy idea was, it just wasn't fast enough to handle moving images. The final piece of that puzzle arrived in 1883 with the invention of a spinning disk featuring a precise series of holes in a spiral ring. Named after its inventor, German engineer Paul Nipkow, the 'Nipkow disk' was purpose-designed to deconstruct an image into a series of points. At high rotation speeds, light from these points formed lines. However, despite patenting the disk in 1884, it would take another 40 years before its use became a practical reality.

Mechanical television

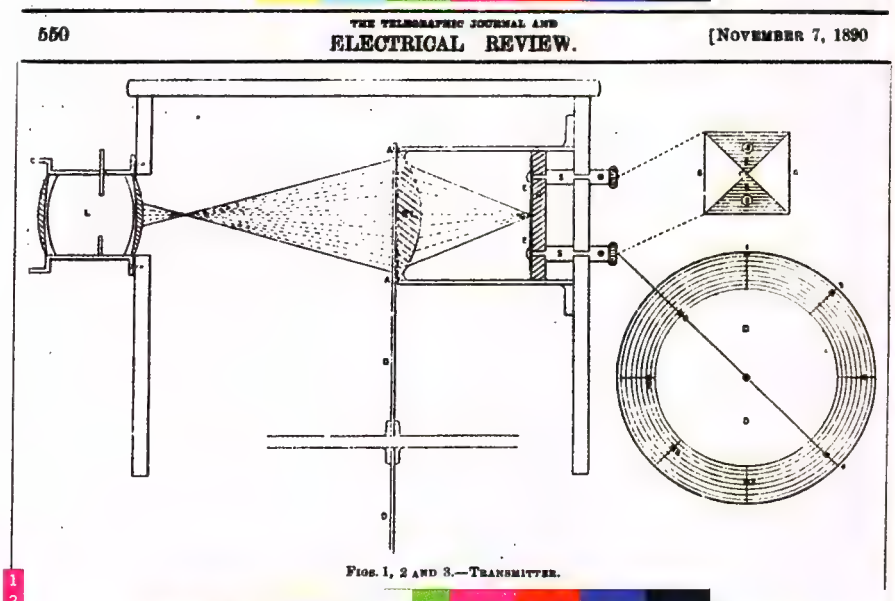
In building upon the ideas of Smith and Nipkow, Baird first demonstrated mechanical television in London's Selfridges department store in 1925, although its operation wasn't for the feint-hearted.

For starters, due to its low sensitivity, Baird's system required objects be lit up under bright lights in order for sufficient light to pass through the spinning Nipkow disk and enable the Selenium photocell to pick up any detail. The other issue was that in order to obtain sufficient resolution, the disk had to spin at speeds in excess of 400 revolutions per minute (RPM). It's reported that on one previous occasion, the disk tore itself off its mounting, clattering through his lab on its self-destructive run.

> "Many world-changing technology inventions are the result of decades – sometimes centuries – of work, building upon foundational ideas to create something new and television was no different"

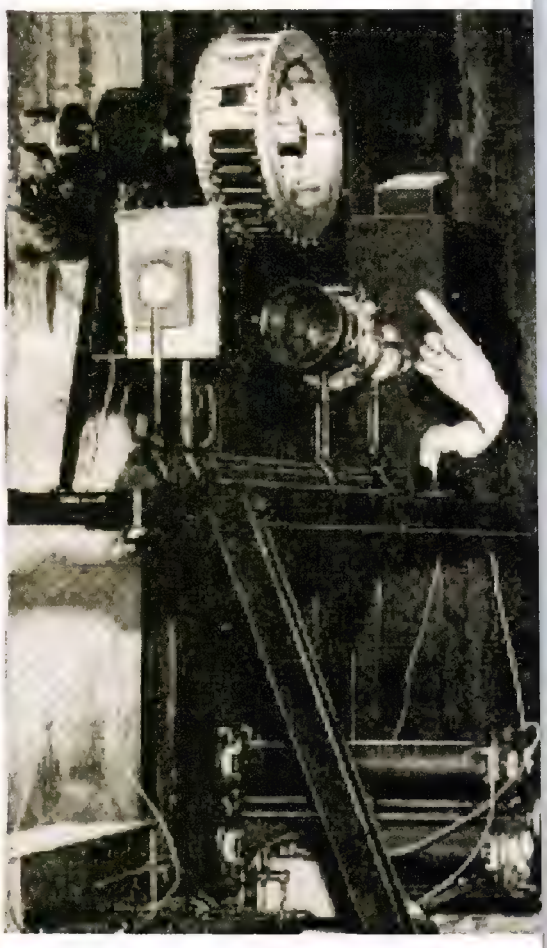
Nevertheless, Baird continued developing the 'Televisor' system, determining that 30 TV lines were the minimum required to recognise a human face. This required a Nipkow Disk with 30 holes in a spiral alignment and became the original television-resolution standard.

After the initial public demonstration, the concept of television quickly gained momentum and by the beginning of 1928, Baird had wirelessly transmitted a


550 THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW. [NOVEMBER 7, 1890

FIGS. 1, 2 AND 3.—TRANSMITTER.

1
2



3

4

television image between London and Glasgow in Scotland, a distance of 700kms. In March that year, he'd spanned the Atlantic with an image transmitted wirelessly from London to New York, a distance of some 5500kms.

Moreover, the story was published in the first issue of the new 'Television' magazine, launched in England that same month. But even more extraordinary was the magazine included plans on how to make your own 'Televisor', including the Selenium photo-cell on which it relied. The pre-WWII era was a goldmine for early experimenters – just as radio spawned a generation of home electronics enthusiasts, television promised the same (imagine Apple launched the iPhone and *APC* published plans to make your own the same month – that's how big of a deal it would've been).

It wasn't until 1929 that Baird was able to convince the BBC to allow the use of its radio transmitters and the first 'Baird Televisor' receiver hit the market that year, offering the now-standard 30 TV lines of resolution. The device was nearly a metre long, half-a-metre tall and produced an image the size of a playing card. Yet despite its limitations, television had well and truly arrived, with Baird's place in history assured. But as we'll see, he wasn't alone – or first – in dreaming of a televised future.

A vision in the field

While Baird was pursuing mechanical television, a young Idaho farm-boy took inspiration from ploughing his potato field to mastermind what would become the first all-electronic vision system. As he watched the slowly growing parallel lines as the field was ploughed, Philo Farnsworth imagined a technique for scanning an image as a series of horizontal lines. The difference here was that there'd be no Nipkow Disk – Farnsworth was aiming for a fully-electronic television system.

It's extraordinary to consider Farnsworth was just 14 years old when he completed drawings of his design and showed them to his science teacher – an act that would later prove pivotal. Those drawings displayed the principles of an electronic television system, including an 'image dissector'.

The Image Dissector

While Baird relied on a spinning disk to break down an image into transmissible segments, Farnsworth envisaged a far more elegant solution that built upon new electronic valve technology.

The Image Dissector essentially does the role of both the Nipkow Disk and Selenium photo-cell in one. It starts by focussing the image in front of the tube onto a photo-sensitive layer that emits negatively-charged electrons in proportion to the light falling on that layer. From there, a set of electrostatic plates focus onto a small section of that layer, allowing the electrons to escape through a small hole to a positively-charged electrode called an 'anode'. By adjusting the electrostatic plates to scan across the photosensitive layer in rows, you get a stream of electrons now forming an electrical signal that represents the image row-by-row. Repeat the process as many as 20 times per second and you get a moving image represented by that signal.

1 Sutton's Telephane (television) transmitter showing the Nipkow Disk, published in 1890
2 Australian engineer Henry Sutton invented a mechanical television in 1885 (Public Domain).
3 Farnsworth's Image Dissector was the first working video camera tube (Public Domain).
4 The U.S. 'Science and Innovation' magazine showed how to build mechanical television in 1928 (Public Domain).
5 Baird demonstrates his Televisor 'camera' in New York, 1931 (Public Domain)

At the receiving end, the signal is processed into an electron beam inside a cathode-ray tube. Farnsworth embedded special synchronisation pulses into the signal to direct the beam via sets of magnetic fields to the tube's front surface in the same series of rows. This beam causes the tube's phosphor coating to glow in proportion to the signal voltage and the image to appear.

In early September 1927, the 'image dissector' camera tube was complete and Farnsworth conducted the first demonstration of electronic television. It may have only captured a single line of vision, but it was a fully-electronic system and something ahead of its time. And just to put the exclamation mark on it, Farnsworth was then just 21 years old.

While that first Image Dissector still had flaws, the realisation of all-electronic television with 1920s' technology by someone who was barely into his twenties himself is a remarkable achievement. However, Farnsworth's greatest battles – and arguably, successes – were yet to come.

Television, a collective effort

Still, it must be said that Baird and Farnsworth were just two of a small army of scientists and engineers around the world grappling with creating practical television. Other names we cannot forget include Boris Rosing and Vladimir Zworykin. Both natives of St. Petersburg in Russia, Rosing began experimenting with television in 1902, filing a Russian patent in 1907 for what essentially was the first working television. It featured a mechanical camera, but an all-electronic receiver using a very early cathode-ray tube.

Vladimir Zowrykin worked with Rosing after graduating from St. Petersburg Institute of Technology in 1912, but fled to the U.S. during the Russian Revolution of 1918. He joined the Westinghouse company in research, filing a patent in 1923 entitled 'Television Systems'. A modification was filed two years later to include – amazingly – television in colour. However, his system still relied on a mechanical camera, but like Farnsworth, Zworykin would play a larger role in the decade ahead.

Australian invents television – in 1885

Given television's 1920s origins, it seems jarring that Australia's television story didn't begin until some 30 years later in 1956, with the first broadcast by Sydney station TCN-9. Yet, it turns out the Australian government did begin looking seriously into television in Australia during the early-1940s, but as WWII roared closer to home, any idea of local broadcasting was shelved for the post-war era.

But that isn't even half the story – in a real 'Back to the Future' moment, the astonishing reality is that Australia invented the world's first television system back in 1885, preceding Baird and Farnsworth by almost 40 years and Rosing by twenty – and it's all thanks to the work of an unassuming engineer and inventor from country Victoria you've probably never heard of.

Henry Sutton was born in Ballarat just three weeks before the first passenger train ran between Sydney and Parramatta in September 1855. He became a prolific inventor and by the time he was 30, he'd already invented a new rechargeable battery and demonstrated a light bulb only weeks after Thomas Edison on New Year's Eve 1879.

However, in 1885, just two years after Nipkow created his 'disk', Sutton invented the mechanical television, incorporating the telegraph as the signal transfer link and the Nipkow Disk to scan and 'draw' the image. His 'transmitter' even used Smith's 1866 discovery of Selenium's photo-conductivity properties, while the receiver implemented a variable-transmission device based on polarised light called a 'Kerr cell'. The overall concept was known as 'distance vision' and Sutton dubbed his device the 'Telephane'. But his reason for developing it could not have been more 'Australian' – living in Ballarat, he wanted to see the running of the Melbourne Cup!

Sutton, however, didn't patent his ideas and the technology to amplify the weak image signal (the triode electronic valve) wouldn't exist for another 20 years. Nevertheless, he published his research paper 'Tele-Photography' in the November 7, 1890 issue of the British journal 'Telegraphic Journal and Electrical Review', research that is said to have later influenced Baird (and, I imagine, probably others). You'll find it at the Internet Archive (**https://tinyurl.com/suttontv, Volume 27, page 549**).

Sutton reportedly met Nikola Tesla during a trip to London in 1892, after which Sutton was in no doubt that the transmission of vision via radio-waves would one day become a reality, yet one he sadly wouldn't see. Sutton passed away in 1912, aged just 56.

Henry Sutton achieved many notable inventions during his lifetime. Professor Mark Dodgson of the University of Queensland describes Sutton in Lorayne Branch's biography of her great-grandfather as "Australia's greatest ever inventor and, indeed, one of the greatest inventors the world has ever seen". So, it's an absolute travesty that he is not more widely known in Australia. Sutton wasn't into fame and retired Victorian Science Museum curator Geoffrey Holden told the ABC that Sutton was happy for many of his designs to enter the public domain.

Sounds like an Australian whose name we should long remember. ■

Next time

The 1920s delivered practical television, but it would be the following decade that delivered on all fronts. Next time, we move into the 1930s, where not only electronic television thrives, but the growing threat of another war focusses science to see over the horizon – and under it. *See you then.*

Windows 10 Stick, Upgrade or Switch?

With hundreds of millions of computers still stuck on Windows 10, due to go end of life in 2025, we investigate your options.

CONTRIBUTORS: LEE GRANT, JON HONEYBALL, [illegible], DAVEY WINDER

Don't panic!

Those were the words so famously written across the *Hitchhiker's Guide to the Galaxy* in Douglas Adams' eponymous book, and they apply equally well here. Windows 10 has already stopped getting new features and security updates will come to a halt in October 2025. The clock is ticking.

While you shouldn't panic, you should think about what happens next before your hand is forced. Follow Microsoft's advice to the letter and that perfectly functional PC or laptop will be consigned to landfill, as security updates end. Lee, in his words to the right, is not happy about that.

Perhaps you want to wait it out. Maybe Microsoft will bow to the pressure and keep releasing security updates? Or you could simply keep running Windows 10 anyway.

We don't think that's a great idea. If you can upgrade to Windows 11 – and by now you'll have been nagged many times by your installation – then we recommend doing so. If not, then you do have options. We explore what Linux Mint and Tiny11 have to offer. There's also the streaming option. Jon Honeyball delivers his verdict on that.

We also give the final word to Jon. What, we asked him, would he tell someone down the pub if they were still running a Windows 10 system? And what about a small business that had a few older PCs still going in its fleet? As ever, he wasn't backward in coming forward with words of wisdom.

Don't landfill that old PC

LEE GRANT IS NOT OVERLY IMPRESSED BY MICROSOFT FAILING TO PROVIDE AN UPGRADE PATH

There's always a better option than automatically shoving an old PC into landfill. First, let's look at the machine. A ten-year-old desktop PC may include a 4th gen Core i7, with 16GB of RAM and decent graphics. Even today, something like that will perform for everyday needs. It may need a cheap SSD upgrade to give it some pep, but that goes for 99% of machines with spinny drives.

If the machine is a decade-old Athlon 2, then running Windows 10 is probably hard work. However, adding copious amounts of RAM to an old machine is as cheap as chips, and switching from 4GB to 16GB will help even the slowest CPUs.

Fundamentally, this is a software issue. Windows 10 is much more sluggish than previous versions of the OS, so ditching Microsoft for a good, user-friendly software option – Ubuntu, Mint, ChromeOS Flex – breathes new life into old kit and keeps them out of landfill. As we move towards a browser-based existence, a quick OS and an up-to-date browser will satisfy the needs of many users.

Landfill should always be the last option. There will be parts inside a ten-year-old machine that others can make use of. The whole machine may be useful to someone who isn't unalterably besotted with Windows and is willing to explore alternatives that other platforms can offer.

If you decide that the machine no longer fits your needs, then give someone else a chance to use it. There are organisations all over the country who take in machines, refit them and give them to people stuck in digital poverty. Via these organisations, the machines can also be sent to places where some genuine recycling will take place – and perhaps some rare-earth element extraction. The uncomfortable reality of sustainability is that we all need to buy less stuff, so keeping something in use is part of that deal.

Microsoft, by killing Windows 10 without an upgrade path for old hardware, is condemning millions of machines to a crusher. It can wave its green credentials all it likes. This is on its shoulders.

"Landfill should always be the last option. There will be parts inside a ten-year-old machine that others can make use of."

Linux Mint

NIK RAWLINSON IS ALREADY A LINUX CONVERT. HERE, HE OFFERS A FEW GOOD REASONS TO SWITCH.

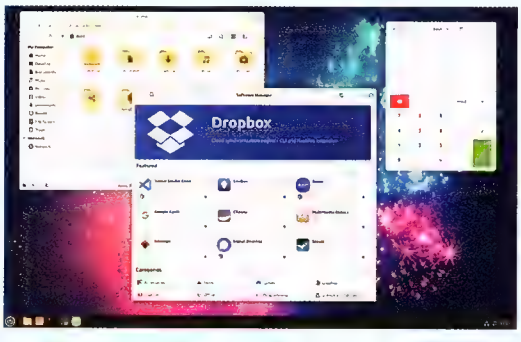
Linux was once the standard but never entirely helpful answer when asked what to do with an old computer. For many, it was an academic exercise: something you tinkered with when you'd moved to a new machine and could afford to corrupt your old workhorse. There was no guarantee that a Linux machine would play nicely with your existing data, sharing files with friends and family could be difficult, and the overall process could often have often been a lot more user friendly. None of that is true today.

A FAMILIAR ENVIRONMENT

Let's be blunt: there's no reason why Linux shouldn't be your primary operating system. Most of your data is platform agnostic, many apps run in the browser, and Linux itself is as friendly and easy to use as Windows.

Ubuntu might be the best-known distribution, but Linux Mint (linuxmint.com), which is based on Ubuntu, is where many Windows switchers end up. Where Ubuntu uses the Gnome desktop environment, Mint uses Cinnamon by default, but can also work with MATE or Xfce. Cinnamon retains many Windows constructs that Gnome lacks, including the taskbar, applets and desklets (reminiscent of Windows' desktop gadgets).

I also recommend checking out Zorin OS (**zorin.com**), particularly if you'd be happy to pay $39 for the Pro edition. This includes one of the best Windows 11 desktop themes you're ever likely to come across.



Linux Mint comes with most of the tools you need pre-installed.

LONG-TERM SUPPORT

Linux may only command around 3% of the market for desktop operating systems, but the community that uses it is active and supportive. You'll have no trouble finding help when you need it, nor in keeping your system secure. Linux checks for patches and downloads them as required – just like Windows Update. The latest release of Linux Mint, version 21.1, Victoria, is based on Ubuntu 22.04 LTS, so will receive support until April 2027. That makes it a great choice for long-term deployments.

A FRIENDLY INTERFACE

Using Linux once required familiarity with the command prompt, but that's rarely the case today. You can install software without touching the keyboard, thanks to built-in app stores, and comprehensive Setting applets make configuration easy.

Nor do you need to relearn your Windows muscle memory. Well-established keyboard shortcuts carry across, so you already know 90% of what you need to get started.

ACCESS TO YOUR DATA

Mint comes bundled with LibreOffice, which offers broad compatibility with Microsoft's Office document formats. Linux distributions don't have access to the Calibri or Cambria fonts used in Office, but alternatives are available. Carlito (**fonts.google.com/specimen/Carlito**) and Caladea (**fontlibrary.org/en/font/caladea**) were designed to be metrically equivalent to Calibri and Cambria, and Microsoft has made other fonts available for installation using Terminal. On a Debian operating system like Linux Mint, the necessary command is:

sudo apt install ttf-mscorefonts-installer

The package includes Arial, Times New Roman, Georgia, Courier New, Impact and Verdana.

SAVE MONEY... AND THE PLANET

Linux Mint requires 2GB of RAM, 20GB of disk space and a 1,024 x 768 display. Compare that to Windows 11, which needs double the RAM, 64GB storage, an HD (720p) display and, crucially, Trusted Platform Module version 2 (TPM 2). If you want to keep older hardware running into the future without compromising security, Linux is your best bet. It can also help reduce your contribution to the world's e-waste mountain.

CARRY ON RUNNING (SOME) WINDOWS APPS

Switching to Linux doesn't necessarily mean losing access to the apps you rely on. Mainstream Windows apps such as Inkscape, DaVinci Resolve and Thunderbird have Linux equivalents, others run in a browser, and many older programs can be run using WINE (**winehq.org**). WINE is a Linux environment that acts as a Windows layer on top of the Linux OS. It isn't installed by default, but you can set it up through the Terminal.

WINE supports 30,000 Windows apps, including Photoshop CS6, Excel 2016 and WordPerfect X3. When browsing the list (**appdb.winehq.org**), favour apps with Platinum or Gold ratings, as these are considered to work without issue. You'll need your old installation media to set them up.

WHY NOT LINUX MINT?

So far I've presented the arguments for Linux Mint, but some might ask why not run Ubuntu instead? You'll receive updates sooner and there will be fewer links in the dev chain as your OS won't be an adaptation of an existing operating system. And you will notice that I only say "some" Windows apps work. Not all. If you need to run specific versions of apps there's often no option but to stick with Windows or switch to macOS, where equivalent versions exist. In this case, if your hardware doesn't have the specs required by Windows 11, check out Tiny11.

Tiny11

WE ASKED NIK RAWLINSON TO MOVE OUT OF HIS COMFORT ZONE AND GIVE THIS STRIPPED-DOWN VERSION OF WINDOWS 11 A TRY.

Tiny11 is a stripped-down version of Windows 11. Where the full-fat OS requires 4GB of RAM and 64GB of drive space, Tiny11 can manage with 2GB and 8GB respectively. It looks like the perfect solution for older machines that fall short of Windows 11's specs as, in the developer's words, it will run on "basically any computer that also ran Windows 10".

That might leave you wondering why Microsoft, with all of its resources, didn't manage the same. The answer is most likely that Microsoft didn't want to: its goal was to ship a feature-rich operating system that was a genuine step up from Windows 10, rather than a minimised working environment.

Tiny11 developer NTDev hasn't stripped out everything. Accessibility features and smaller apps such as the Calculator and Notepad, plus Windows Terminal and PowerShell, have all been retained. Microsoft Store is also in there, so you can manually update applications and add new ones as required. You can download Tiny11 from **archive.org/details/tiny-11_202302**.

Keep old hardware running

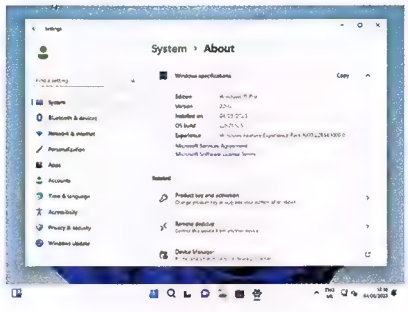
The most obvious benefit of Tiny11 is that it should continue running efficiently on older hardware over the longer term, not merely the next year or two. Nor does it comes with Microsoft bloatware: both Edge and Teams have been removed. You can add them from the Microsoft Store, or choose an alternative browser and log in to Teams on the web.

There are two versions of Tiny11 available for download, one of which is designed for older hardware that lacks support for TPM2; this handles on-device encryption and was a key requirement blocking many users from upgrading incompatible machines. Neither does Tiny11 require secure boot.

Save yourself from manually debloating

You could install a regular build of Windows 11 and strip out the features you don't require. There are utilities to help you achieve this, such as Debloos/BloatyNosy (**https://github.com/builtbybel/BloatyNosy**), which can analyse your system and automatically remove what it considers bloatware, or give you the option of manually removing components you don't need and have no plans to use.

However, you can only access post-production apps such as BloatyNosy if you've already successfully installed Windows 11, which won't always be possible. Tiny11, on the other hand, is an all-in-one solution where installation is possible precisely because it's been stripped down in advance.



"Where the full-fat OS requires 4GB of RAM and 64GB of drive space, Tiny11 can manage with 2GB and 8GB respectively."

Run the apps you know

The benefit of sticking with an operating system based on Windows 11 is that you can continue running the applications you already use. There's no need to use a workaround such as WINE under Linux, and nor is there any need to learn how to use a new OS or apps. You can avoid converting your data from its original formats, too.

Use a local user account

By default, Tiny11 uses a local account, rather than a Microsoft account, so your activities are less intimately linked to your profile (you can revert to a Microsoft account if you prefer). If you're particular about your privacy, this could be a reason to switch on its own – particularly as Microsoft is now encouraging Microsoft account login as the standard option.

It's improving all the time

Tiny11 hasn't come out of nowhere: it's a follow-on from Tiny10, so has been in active development for several years. As such, it's improving over time. The first release achieved its small size through the removal of the Windows Component Store, which made it impossible to add new features and languages. However, release notes for the latest build state that Windows Component Store is back, in a release that also sees the removal of sponsored apps.

Why not Tiny11?

So, are there reasons not switch to Tiny11? For sure. First of all, it isn't an official build. It's not supported by Microsoft and there's no guarantee it will keep working in the future.

Neither is Tiny11 a free operating system. If you don't already have a code to activate Windows 11 Pro, you won't be able to activate Tiny11, so if you're installing it as a money-saving measure, I'd recommend taking another look at Linux (in fact, unless you absolutely have to run Windows, that's still what I would recommend people do).

Tiny11 may be the best-known stripped-down build of Windows 11, but it isn't the only option. Ghost Spectre 11 (**archive.org/details/ghost-spectre-windows-11**) likewise lets you install a debloated build on machines without TPM support.

ReviOS (**https://revi.cc/revios/download/**) is another stripped-down OS, removing common tools such as Photos and Windows Mail. It also avoids pre-installed apps such as Disney, plus core features such as the Telemetry Client, screensavers and themes.

All of which is to say you have choice. Download, play, and consider your options.

Windows 11 in the cloud

THERE IS A NOVEL, IF PAINFULLY EXPENSIVE, OPTION: STREAM A WINDOWS DESKTOP INSTEAD. JON HONEYBALL DELIVERS HIS VERDICT.

Windows 365 – not to be confused with Microsoft 365, the new name for Office – has been largely hovering under the radar for more than a year now. It allows you to stream a Windows 11 desktop to pretty much any device (or Windows 10, for that matter).

Microsoft offers a free month's trial of Windows 365 before you have to commit to an annual subscription. However, when Barry Collins tried to sign up it was an exercise in pure frustration: the procedure flopped at the payment confirmation screen, at which point he was given an error code and told to call Microsoft. I'll save you the pain that stemmed from that...

So what do you get? A Windows session that you connect to from your PC, Mac or tablet, running in a window in a browser. You can connect via other technologies, but I suspect most will use a browser like Microsoft Edge. Just for fun, I used Apple Safari on a Mac.

Once your account is set up, you need to subscribe to the level of capability that you want and add it to your account. For most users, this will be done by their business administrators. I chose the Windows 365 Business plan, which offers three levels of hardware: Basic for $58 per month gives two vCPUs, 4GB of RAM and 128GB of storage. That's not a lot of hardware capability, especially for RAM. With nothing running, about 3GB of that 4GB was taken already. However, it didn't hesitate much with Word and Excel running, so will be fine for single-task operation.

Next up is Standard at $76.70 per month, which simply doubles the RAM to 8GB; you can also choose Premium at $123.50 per month, which increases the CPU count to four vCPUs and 16GB of RAM, again with storage at 128GB. The Enterprise versions offer the same pricing for the same configurations, but you aren't limited in user count.

You aren't restricted to these specs: a configurator allows for almost any combination. At the cheapest end of the scale, you get a two-vCPU system with 4GB of RAM and 64GB of storage, which in terms of specs matches the worst possible system you'll find on the shelves at an electronics shop. At the other end of the scale, you can rent an eight-vCPU system with 32GB of RAM and 256GB of storage.

There's also a Windows Hybrid mode, which allows you to run Windows 10 or 11 Pro on existing hardware, reducing costs by 10%.

Each setup comes with Office preinstalled, but you'll have to use one of your own licences. And note that the Basic level supports Teams only for chat and audio calls, not for video.

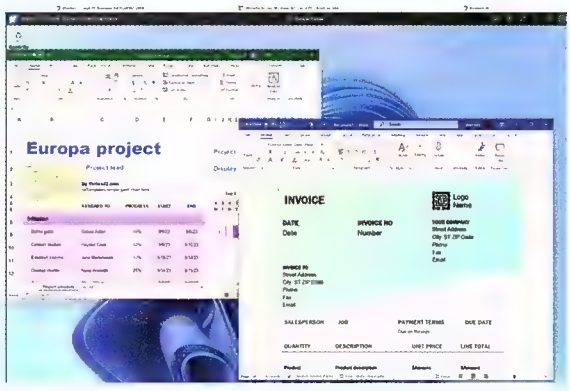
Why choose the cloud?

So what are the top reasons for using this? First, Microsoft takes care of all OS updates, security updates and apps, too. That's one management headache instantly removed. Second, it's portable. Since you usually access the instance from a browser, you can get to it from most any device.

Reason three? It's going to be largely immune to any compromises of the client, because the whole session is running in the cloud. Four: the session never ends, and you don't shut it down. It just freeze-dries until you log in again, picking up from exactly where you left off. This can be compelling if you move between devices a lot.

All of this makes it a fine solution for anyone who simply wants Microsoft Office and a browser.

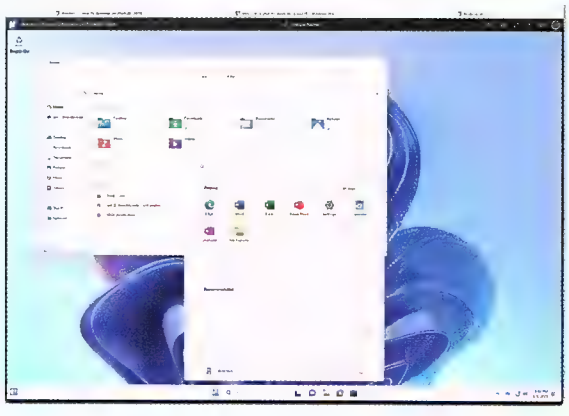
However, there are a bunch of downsides that can't be ignored. Top of the lot is cost. This is really quite expensive compared to the price of a desktop or laptop, especially when viewed over a multi-year period. Second, your options for adding in third-party apps or other items is severely constrained. Streaming really is only for the Office plus browser community.



Each setup comes with Office preinstalled, but you'll need a licence.

Which ties in to the next big problem: there's no obvious migration path from your existing PC to the cloud. Although it would be very complicated to do, it would be nice to have a "suck the brains of my desktop and park it in my cloud Windows please" applet. You need to think of this as a clean start in a clean Windows session, for most users.

Finally, we come to the unavoidable fact that this is for businesses only. It isn't a Windows Home-oriented product. So while it might at first seem the ideal solution for an aunt or wayward teenager, the inherent complexity of licensing for the business and enterprise customer puts it out of reach for domestic users.



Your selection of apps is quite limited, even on the top tier.

Windows 10 end-of-life security reality check

DAVEY WINDER EXPLAINS HOW VULNERABLE YOU'LL BE IF YOU DECIDE TO CARRY ON USING WINDOWS 10 PAST ITS SELL-BY DATE.

Windows 10 is not yet an ex-Windows. It is not preaching to the choir eternal, and it has not ceased to be. Yet, it will soon become as dead as the parrot in that famous Monty Python sketch. So, what will this mean in terms of the security of your data?

First of all, dates and details are important here. Windows 10 Home and Professional 21H2 won't get any more security updates, having hit end of support on 13 June 2023. Organisations running Education and Enterprise versions have until 11 June 2024.

If you've updated to version 22H2 then security updates will continue until 14 October 2025. And note that this applies to all versions, including Education and Enterprise.

RUNNING WINDOWS 10 AFTER 14 OCTOBER 2025

The security implications of continuing to use a legacy version of Windows long after the security updates have stopped are best illustrated in one word: WannaCry. The 12 May 2017 worm was spread using a vulnerability within the Microsoft Windows server message block (SMB) protocol. A vulnerability that had been patched two months prior. Organisations that hadn't yet patched, or couldn't patch as they were running unsupported versions of Windows, were most exposed.

Recent research revealed that some 76% of the vulnerabilities used in ransomware attacks in 2022 were at least three years old. The oldest dated from 2012. These were not all Windows vulnerabilities, of course, but it does stress the importance of keeping up to date with patching.

While there's no such thing as absolute security, there is a spectrum of better to worse, and running end-of-life software swings you heavily towards the W. Unpatched vulnerabilities spring to mind, but collateral damage also comes into play. Not least, compliance issues in regulated industries, legal liability if a breach can be shown to come back to an unsupported system, and even the likes of Cyber Essentials Plus certification not being available, which could swing your customers away to certified competitors.

REAL-WORLD SECURITY MITIGATIONS

The requirement for a TPM 2 chip to run Windows 11 means that a lot of older hardware isn't up to the job, and upgrading large numbers of machines is not an option for some businesses. However, most new computers will be compliant, and there aren't too many UI issues when switching from 10 to 11. Certainly not as many as when switching from XP to 7, for example.

When it comes to the remaining mitigations, these can be split into three groups: high-cost, wing and a prayer, and practical.

The high-cost option will be if Microsoft offers extended support. This has been the norm historically, and while there's no guarantee that it will happen with Windows 10, I'd be extremely surprised if it didn't. I'd be equally surprised if the cost weren't enough to bring a tear to the finance director's eye. A cost that increases with every year it's renewed. Migrating to Windows 11 will likely sound cheap by comparison. Then there's the wing and a prayer option, by which I mean the simple fact that Microsoft has a history of releasing "emergency" security updates for unsupported software when the circumstances are severe enough: WannaCry patches for XP and Vista in 2017, PrintNightmare patch for Windows 7 in 2021. The problem is that for each of these critical situations, there are hundreds of critical and high-rated vulnerabilities that will go unpatched. Relying on out-of-band emergency updates doesn't make for a workable security policy.

PRACTICAL MITIGATIONS?

Which brings us nicely to the answer for most people, most of the time: the practical mitigations. Faced with criminal actors who will be actively looking to exploit unpatched Windows 10 vulnerabilities, there are numerous things you can do to mitigate the risk of your legacy machines. You will likely only need legacy support for specific software needs, so run those within a virtual environment where possible. If it's a matter of specialist hardware that can't be run virtualised, then look to network isolation instead.

The security implications of continuing to use a legacy version of Windows long after the security updates have stopped are best illustrated in one word: WannaCry.

You might also want to consider third-party patch providers. These tend to fall into two camps: virtual patching and micro-patching. The former has the advantage of speed, as it applies an additional security layer using pattern-matching to spot known vulnerabilities. This is also a weakness if the attacker obfuscates that vulnerability pattern. Micro-patching, the best-known example being 0Patch for Windows, acts like a traditional vendor patch, correcting the vulnerable executable code. 0Patch often releases patches before an official Microsoft patch is available.

Let's conclude with a reality check: the best risk mitigation is to upgrade to the latest Windows operating system.

The Honeyball verdict

WE ASKED JON HONEYBALL TO SHARE THE ADVICE HE WOULD GIVE TO SOMEONE DOWN HIS LOCAL IF THEY WERE STILL RUNNING WINDOWS 10 FOR PERSONAL OR BUSINESS USE.

What's that I hear on the jukebox? "All Good Things (Come to an End)" by Nelly Furtado? How apt. For that saying is as true for a balmy summer as it is for operating system support. Windows 10 has aged well, but the carriage clock is ticking. Windows 10, 22H2 version, will go into retirement on 14 October 2025. That might be around two years away, but it's somewhat startling as to how quickly that time will pass.

But, you ask, what am I to do? The answer to that depends almost entirely on where you are now.

Of course, you're on the current build of Windows 10 aren't you? You keep it up to date, patch all third-party code including browsers, and have appropriate disaster recovery and archive solutions in place? If not, don't even finish that pint: head back to base and tick those boxes.

Note, by the way, that I consider disaster recovery and archive solutions to be two separate things. This is not the time to go into exactly why, but I hope the answer is obvious enough.

While we're talking hard truths, don't be lulled into a state of relaxation due to the fact that Windows 10 is still doing good work. You wave me away. It fulfils my needs, you say, and I can see the call to change is falling on somewhat deaf ears. Allow me to raise my voice. Although it's tempting to put your head in the sand and shout "La la la la", this isn't a wise course to take.

SOFT CHOICES

Let's walk though some alternatives. The first and most obvious answer is "upgrade to Windows 11". I understand why you might prefer Windows 10's look and feel, and think that a Start button should never be in the middle of the screen. You might find Microsoft's attempts to make things cuddly and helpful almost offensive. But the inescapable reality is that Windows 11 is the path of least resistance for you moving forward.

Therefore, if you have an upgrade path, then I would recommend that you take it.

OLD HARDWARE

However, we will now hit some roadblocks. There is perfectly serviceable hardware out there running Windows 10, and it cannot, at least at present, upgrade to Windows 11. I have such a device here (don't ask me why I brought it to the pub): a 27in Dell XPS all-in-one desktop PC. It includes an Intel Core i7-7700 CPU, but Microsoft's PC Health Check app says this isn't supported. At this point, there is a temptation to say "that's all folks!" But it isn't quite so clear cut.

The list that Microsoft uses to determine whether something is a valid upgrade target appears to be changing over time. And it depends on which version of Windows 10 you're on. For example, I have seen examples where joining the Insider Build channel and then choosing the Beta channel has allowed hardware running Windows 10 to upgrade to Windows 11, despite the Health Check app saying it isn't valid.

This might well happen to your computer. On the assumption that it's reasonably recent hardware, it might simply be that Microsoft hasn't yet finalised the upgrade path for that combination of hardware. That means it might come in the near future, once some miracle has occurred in Redmond that deems that currently "not supported" magically becomes "supported".

So, if you're in no rush, I would stay put on Windows 10, and wait to see if it becomes supported in the next two years.

If you can't wait, then try the Insider trick with the Beta channel, and maybe that will deliver the upgrade for you now. After all, you've got a full backup of all your data, and a disaster recovery plan in place to take you back to Windows 10 should everything go badly wrong. You have, haven't you?

HARD CHOICES

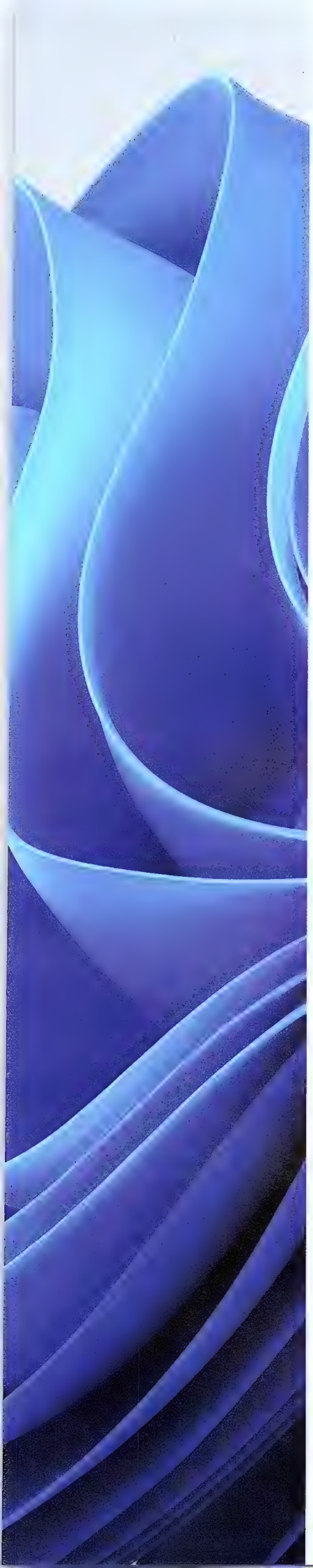
The next alternative is to consider changing the hardware. While this isn't such a big deal in a business or corporate environment, where one-quarter of the hardware estate is changed out each year, it can be something of a shock to the home user.

Nevertheless, it's worth looking at the device and considering its age. A PC that's pushing towards teenage years is going to become a reliability liability. If it's nearly reaching its tenth birthday, it might be worth considering buying new hardware, especially if it's a laptop, a market segment that has seen huge improvements in the past decade.

That way, you'll get Windows 11 by default, new hardware and current driver support, and a future support plan from Microsoft that runs for the foreseeable future. Even if Windows 12 is released next year, Windows 11 will continue in support until nearly the end of this decade.

If you do decide to change hardware, then don't immediately throw away your

"Although it's tempting to put your head in the sand and shout "La la la la", this isn't a wise course to take."



> "If you do decide to change hardware, then don't immediately throw away your current machine. Make sure all of your data is safe, and consider moving to a different OS platform as detailed elsewhere in this article."

current machine. Make sure all of your data is safe, and consider moving to a different OS platform as detailed elsewhere in this article. My favourite is Linux Mint Cinnamon, simply because it's the most "Windows-like" that I've found. There are tools to let you try it out, booting from a USB stick. And it's usually simplicity itself to repartition the hard disk and allow Mint to sit alongside the existing Windows installation. You might well be stunned as to how quickly Mint will run on relatively recent hardware.

Of course, everything comes down to apps. If your work rotates around Microsoft Office and web apps, then LibreOffice and a choice of browsers will deliver everything you need. If you're wedded to a rather old version of Photoshop, then more consideration needs to be taken. And then the dual-boot mode can be useful to keep the old Windows installation for irreplaceable tasks, and use the Mint installation for all ongoing work.

If Linux doesn't appeal, don't throw it away.

BUSINESS CHOICES

What's that? You run a small business? I really should be invoicing for this advice, but buy me another pint and we can talk.

Tortured scene-setting aside, a different set of rules apply if you're a small business. That's due to the benefits of tax write-offs, and the requirements of businesses to have reliability. There's little point in sending a travelling salesman to a customer 150 kilometres away only for the laptop to die when they arrive.

For a small business, then, your choices are simple. Upgrade now to Windows 11 if you can. If the hardware won't support it, leave upgrading the hardware until an appropriate point is met, but ensure that everything has been transitioned to new hardware by no later than 1 March 2025. That gives six months to ensure there are no unexpected problems.

This date, however, means that work needs to start now on considering how to move business-critical apps forwards to Windows 11. Again, if the users are just working in Microsoft Office and a web browser, with a smattering of Teams meetings, then there are unlikely to be issues. But small businesses have a habit of acquiring some very weird and wacky apps, often written years ago, and unfortunately often out of support.

CUSTOM APPS

If you have such a line of business application, and support is a historical memory, then work must start now to decide what to do. Is there a newer version from the same developer? Can the data be exported and read into an alternative application? What will be the cost of the licensing, along with realistic costs for installation, and then training of the existing users?

If it relates to your business accounts, then talking to your accountants about making the change at year-end can certainly help. Only the desperate change accounts packages in the middle of a financial year.

If the app is so critical that you can't move from it, and it doesn't work on Windows 11, then you have a ticking time bomb. Consider trying to run it in a virtual machine, although this approach can add more complexity than it fixes.

Finally, look carefully at the hardware you have and consider how it is ageing. What is the risk of that machine going bang, and its impact on your business process? This is an especially acute issue in the smaller end of the SMB market, where hope triumphs all sense.

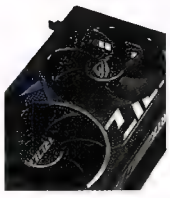
And now, just like Nelly so aptly sung, this lovely time we've had discussing Windows 10 must come to an end. What's that? Another, for the road? Well, it's only a short walk home, I suppose. ■

PC BUILDER

From the front lines of the Australian PC market

System news

The discreet GPU market is in flux and Mark Williams is excited for it.



RTX 4090: still the fastest GPU, still almost $4,000.

The graphics card market is creeping back down to pricing normalcy. There's still a long way to go though.

Going back to 2017, the then top graphics card was Nvidia's GTX 1080 Ti and it sold for around $1,100, not bad right? Sticking with top Nvidia products let's look at how they're priced as time went on. In 2019 the RTX 2080 Ti shocked us with its huge price jump over the GTX 1080 Ti, coming in at $1,800, but with hardware ray tracing and DLSS support at least it gave us never before seen features. Then in 2021 the RTX 3090 during the crypto mining and Covid bubbles was the hottest thing on the market and thus demanded the insane price of $3,800!

Thankfully as the mining boom wound down so too did prices, and in 2022 the RTX 3090 Ti could be had for $3,400, still insane but at least the price had reduced. Now post Covid pandemic lockdowns and with zero crypto mining pressure thanks to Ethereum's switch to the proof-of-stake model, the current top RTX 4090 goes for around $2,800.

"There are a couple of factors keeping prices high. First and most importantly there's the AI boom which Nvidia is throwing all its proverbial eggs into."

As you can see, we're still a long way from the $1,100 of 2017 which even when adjusted for inflation still only comes to around $1,300 in 2023 money.

There are a couple of factors keeping prices high. First and most importantly there's the AI boom which Nvidia is throwing all its proverbial eggs into. There have been observations that stocks of top end Nvidia cards like the RTX 4090 and RTX 4080 in retail stores are slowly dwindling away, as Nvidia appears to be shifting capacity in favour of making products like the Nvidia L40 which uses the same AD102 die but sells for around $23,000, if you can find any in stock.

The second reason is that while AMD's top offering in the RX 7900 XTX comes in at a more respectable $1,700, it is a solid 20% behind in raster performance compared to the RTX 4090, so Nvidia without direct competition can continue to charge basically what it feels like for the time being, at least at the top end.

At the bottom end, last generation's terrible value $250 RX 6500 XT and even worse $400 RTX 3050 may be the last entry level GPUs we'll ever see as AMD is soon to launch its Strix Point and Strix Halo APUs that go hard on the integrated GPU (finally), with Strix Point said to have 16CUs, similar to the RX 6500 XT but with an improved RDNA 3.5 architecture instead of RDNA 2, and Strix Halo coming with a robust 40CUs – which is RX 6750 XT class territory!

Intel will follow suit, slowly, with the laptop bound 14th Gen Meteor Lake integrating Alchemist iGPUs and the later desktop bound 15th Gen Arrow Lake to do the same, targeting similar performance, it'll basically remove the need for any discreet GPUs below a "70" class product, meaning we may not even see the likes of an RTX 5060 or RX 8600.

As a result, the floor price for where discrete cards start at could be much higher in the future, but by then we'll have very powerful APUs that'll dominate 1080p and low end 1440p gaming.

It'll be fascinating to see how the discrete GPU market develops over the next few years.

Mark Williams is an IT professional with a strong interest in voiding warranties.

Market Watch

A sampling of PC systems available this month

IJK SUPERIOR AMD5

$2,379

tinyurl.com/APC526IKJ

This system is a good choice for a first gaming PC. It is possible to get cheaper ones, but this provides a better starting point in some respects. It's on the latest AM5 platform, meaning a drop-in upgrade in a couple of years will be possible. The 32GB of RAM is also nice for longevity.

Unfortunately to keep the price down the main SSD is only 500GB, but there is an additional 1TB of SATA SSD capacity so that can be overlooked.

The graphics card is the weakest link, from near the bottom of last-gen's lineup, but for those starting out it'll do well until it's time to invest in an upgrade.

CPU Ryzen 5 7600X **COOLER** Cooler Master MasterLiquid 240L Core ARGB **MOTHERBOARD** GigabyteB650M Aorus Elite AX **GRAPHICS** Asus GeForce RTX 3060 Ti TUF Gaming 8GB V2 **MEMORY** 32GB Corsair Vengeance RGB DDR5 5600MHz C36 **STORAGE** 500GB Samsung 970 Evo PLUS M.2 NVMe SSD, 1TB Crucial BX500 SATA SSD **POWER SUPPLY** Gigabyte GP- UD850GM 850W **CASE** Thermaltake View 200 TG ARGB.

BPC TECHNOLOGY KRAKEN POWER NEXUS

$2,599

tinyurl.com/APC526BPC

For those who want something unique, this could be the PC for you. This comes with an 8-inch LCD screen at the front of the case. With a resolution of 1280x800, it's enough to show anything from vital PC stats through to playing videos and beyond. The Ryzen 7700 CPU is the non-X version so temperatures will be well under control with the big tower cooler while still offering great performance.

32GB of RAM and 1TB of SSD storage is great to see, especially the fast RAM speeds that Ryzen likes. The RTX 4070 is a solid all-rounder that should cater to just about any use case from 1080p up to 4K (with some upscaling help). A great choice for those serious about gaming but want to be sensible with their wallet.

CPU AMD Ryzen 7 7700; **COOLER** Jonsbo HX6250 Mega Tower; **MOTHERBOARD** Asus TUF Gaming B650M-E; **GRAPHICS** Asus TUF Gaming GeForce RTX 4070 12GB OC Edition; **MEMORY** 32GB Lexar Ares RGB DDR5-6400 CL32; **STORAGE** Lexar NM790 NVMe SSD PCIe Gen4 1TB; **POWER SUPPLY** FSP Hydro PRO 800W; **CASE** Jonsbo D31.

CENTRE COM KARUZA NEPTUNE

$2,699

tinyurl.com/APC526CC

For an extra $100 over the BPC system, this rig offers a lot more grunt for your money. The 13700K is a productivity powerhouse with 24 threads available. A similar RTX 4070 is here too for great native 1440p performance and there's a larger 2TB SSD to house multiple big game title installs.

The 240mm AIO is very much needed on these hot and power-hungry 13th gen CPUs, however the 650W PSU could be a limiter should you want to upgrade anything down the track, 750W or higher would've been nicer to see.

The PSU and the RAM capacity which was cut in half seem to be the victims of fitting the CPU in at this budget. An otherwise very capable machine!

CPU Intel Core i7-13700KF; **COOLER** Corsair H100 RGB 240mm AIO; **MOTHERBOARD** MSI Pro Z690-A WIFI DDR4; **GRAPHICS** PNY Verto GeForce RTX 4070 12GB; **MEMORY** 16GB Kingston Fury Beast RGB DDR4 CL16 3200MHz **STORAGE** WD Blue 2TB M.2 SSD; **POWER SUPPLY** Thermaltake SMART BX1 RGB 650W; **CASE** Thermaltake S200 Mesh ARGB.

PLE COMPUTERS SPEEDSTER

$2,948

tinyurl.com/APC526PLE

At $250 more than the Centre Com Karuza system, it's difficult to justify and seems like poor value. Compared to the Karuza the CPU gets trounced in multithreading, the RX 7700 XT is about 10% slower and around $200 cheaper than the RTX 4070, and the motherboard has a midrange chipset versus the top end chipset in the Karuza.

There is a larger 750W power supply and double the RAM capacity here but that doesn't make up for the huge performance gap. This system seems around $300 overpriced. Best to wait for this one to go on sale or have a serious price reduction before considering.

CPU AMD Ryzen 5 7600X; **COOLER** ID-Cooling ZoomFlow 240 XT 240mm ARGB AIO; **MOTHERBOARD** Gigabyte B650 Gaming X AX; **GRAPHICS** XFX Radeon RX 7700 XT; **MEMORY** 32GB G.Skill Trident Z5 RGB DDR5 C36 5600MHz; **STORAGE** 2TB Kingston KC3000 PCIe Gen4 NVMe M.2 SSD; **POWER SUPPLY** Thermaltake Toughpower 750W; **CASE** Fractal Design Pop Air RGB.

Blueprints

Value- and performance-driven hypothetical builds

Budget. A perfect balance between price and performance.

The GPU market is hard to keep up with these days, especially in terms of pricing. But the upside is that there are now some very interesting, if often fleeting, deals to be had. That's a welcome change from 18 months to two years of hideously high pricing during the pandemic.

Anyway, here's one we'd like to swing past you. How about an AMD Radeon 6700 XT 12GB for $649? This is avaiable at Amazon, and ships locally.

Into our AMD rig it goes. Sure, it's last-gen versus the Radeon RX 7600 it replaces, but critically, it has 12GB, where the 7600 has just 8GB. 8GB is becoming an increasing limitation, even at 1080p. Moreover, the new RX 7000 range brings very little in terms of new technologies. Dollar-for-dollar, it's not any better at ray tracing than the old RX 6000 family, so it's really just a question of raw performance, and the 6700 XT is a solid 30 percent faster. But it's not nearly 30 percent more expensive.

You can't make quite the same argument with Nvidia GPUs, because the latest RTX 40 cards have significant technical upgrades. So while it's tempting to drop in a 3060 Ti from the last gen for its marginally superior raster performance to the 4060, there's a lack of support for Frame Generation.

We're going to take a similar approach with CPUs and slap in a last-gen Intel Core i5 12400F. It's notable that 12th Gen and 13th Gen Intel CPUs are exactly the same architecture on exactly the same process node, it's just the 12400F has six Performance cores to the 13100F's four Performance cores – 50% more cores for 35% more money. We can compensate for that with a slightly cheaper RTX 4060 board in the Zotac Gaming GeForce RTX 4060 8GB Solo, ensuring that our six-core rig only costs $50 more than last month's quad-core machine.

AMD BUILD - Approximate Price $1,498

Case	Corsair 4000D Airflow	$149
PSU	600W EVGA 600 BR 80+ Gold	$79
Mobo	MSI B550M PRO-VDH WIFI Micro ATX AM4 Motherboard	$129
CPU	AMD Ryzen 5 5600	$209
GPU	**PowerColor Fighter AMD Radeon RX 6700 XT 12GB**	**$649**
RAM	16GB (2 x 8GB) PNY XLR8 Gaming Epic-X RGB DDR4 @ 3600MHz	$89
SSD	1TB Lexar NM790 PCIe 4.0 M.2 SSD	$65
HDD	2TB Seagate Barracuda Compute 7200	$69
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60

INTEL BUILD - Approximate Price $1,448

Case	Corsair 4000D Airflow	$149
PSU	600W EVGA 600 BR 80+ Gold	$79
Mobo	Asrock B660M Pro RS Micro ATX GA1700	$199
CPU	**Intel Core i5-12400F**	**$239**
GPU	**Zotac Gaming GeForce RTX 4060 8GB Solo**	**$499**
RAM	16GB (2 x 8GB) PNY XLR8 Gaming Epic-X RGB DDR4 @ 3600MHz	$89
SSD	1TB Lexar NM790 PCIe 4.0 M.2 SSD	$65
HDD	2TB Seagate Barracuda Compute 7200	$69
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60

AMD BUILD - Approximate Price $2,453

Case	Nzxt H7 Flow	$199
PSU	750W EVGA 750 G5 80+ Bronze	$179
Mobo	Asrock B650M PG Riptide Wi-Fi Micro ATX AM5	$315
CPU	AMD Ryzen 5 7600X	$389
Cooler	MSI MAG Coreliquid 240R V2	$129
GPU	**PowerColor Radeon RX 7800 XT Hellhound OC 16GB**	$879
RAM	32GB (2x 16GB) Corsair Vengeance DDR5 CL40 @ 4800MHz	$169
SSD	1TB Lexar NM790 PCIe 4.0 M.2 SSD	$65
HDD	2TB Seagate Barracuda Compute 7200	$69
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60

INTEL BUILD - Approximate Price $2,697

Case	Nzxt H7 Flow	$199
PSU	750W EVGA 750 G5 80+ Bronze	$179
Mobo	Gigabyte Z790 UD AC ATX LGA 1700	$349
CPU	Intel Core i5-13600K	$509
Cooler	MSI MAG Coreliquid 240R V2	$129
GPU	**MSI Ventus GeForce RTX 4070 12GB**	$969
RAM	32GB (2x 16GB) Corsair Vengeance DDR5 CL40 @ 4800MHz	$169
SSD	1TB Lexar NM790 PCIe 4.0 M.2 SSD	$65
HDD	2TB Seagate Barracuda Compute 7200	$69
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60

Mid-range. A game-ready machine that can also handle demanding work.

When it comes to gaming, these mid-range machines are all about high-refresh 1440p with a side order of 4K at more modest frame rates. Happily, achieving that has just got a fair bit cheaper.

The main reason is the arrival of the AMD Radeon RX 7800 XT at $880. Okay, it only represents a very small step in performance over the old 6800 XT, which can now be had for similar money, but that GPU is not long for this world. More to the point, as a new-gen GPU, the 7800 XT puts much more pressure on Nvidia than the last dregs of an older generation being sold off cheap.

That's why several lower end and mid-range Nvidia RTX 40 Series graphics cards have had haircuts. You can now get an RTX 4070 for $900. That's still not a bargain, especially given the AMD 7800 XT is cheaper, but faster for raster, if not for ray tracing, and has more VRAM. But the RTX 4070 is now down to a level where we'd be reluctant to opt for the particularly poor RTX 4060 Ti.

So in goes the Asrock Challenger Radeon RX 7800 XT 16GB to our mid-range AMD build. At $879 it's more expensive than the 6750 vanilla card it replaces, but as a new-generation GPU, it's a much better long-term bet. Elsewhere, we're sticking with the six-core Ryzen 5 7600X, which remains an excellent gaming CPU, as well as all the other key components, including the Asrock B650 motherboard, 32GB of Corsair DDR5, and a 1TB Lexar SSD. The total price for the rig edges up to $2,453.

As for the Intel rig, we're all too happy to ditch the MSI Ventus 2X Black OC GeForce RTX 4060 Ti 8GB in favour of an MSI Ventus GeForce RTX 4070 12GB. While it's a fairly substantial step up from $679 to $969, we reckon it's worth every cent. The 4060 Ti ultimately isn't well equipped for 1440p gaming. It's not even great shakes at 1080 in some games that eat up a lot of VRAM, so we'd far rather pay $2,697 for a proper 1440p rig than $2,377 for something sub-standard.

"These mid-range machines are all about high-refresh 1440p with a side order of 4K at more modest frame rates."

High-end - A game-ready machine that can also handle demanding work.

As ever with our fastest builds, the opportunity for radical change is somewhat limited. Once you already have the fastest available AMD or Nvidia GPU, you can't really upgrade it, at least not until those rare occasions when a new generation of graphics hardware is released. Likewise, CPUs – new chips only come along so often.

That said, it's worth noting that AMD is making a bit of a push with Starfield bundles of late, so you can effectively subtract $120 from most Radeon RX 7000 series board prices. This month, we'll go with the PowerColor Hellhound Radeon RX 7900 XTX 24 GB, which is yours for $1,599 from most shops. That's a decent discount on the $1,789 launch price of the 7900 XTX, and a good deal for a GPU, with raster performance comparable with an RTX 4080 which costs around $1,000 more.

That said, it's nice to note that the Asrock X670E PG Lightning ATX AM5 has dropped by $90 this month, reducing the overall AMD rig price down below $4,700. Pretty impressive for a machine with everything just about maxed out.

The AMD Ryzen 7950X3D CPU saw a price fall thismonth, which is rare yet pleasing. It's down from $1,085 last month to $949 now. This remains AMD's top performing CPU, and is especially good for gaming.

Over on the Intel side of the divide, Nvidia's RTX 4090 remains stubbornly stuck at around $2,800. Still, that is actually a relatively decent deal for what is absolutely, unambiguously the fastest GPU you can buy, and will remain so for at least another year, and quite possibly well into 2025, what with Nvidia's next-gen RTX 50 series looking like it won't arrive until early 2025, and AMD rumoured to have cancelled its high-end RDNA 4 GPUs.

That said, there are very slim savings to be had by swapping out the Intel Core i9-13900K for the 13900KF alternative. The two chips are identical, save for the integrated graphics being disabled in the "KF" model. You're not going to be using that silly integrated graphics in the "K" model, are you? So there you go, we're swapping it in. We've just saved you $20, bringing the overall price to $5,641. To quote the long-suffering Dr Lazarus, by Grabthar's Hammer, what a savings.

AMD BUILD - Approximate Price $4,691

Case	Phanteks Enthoo Pro 2 Tempered Glass	$299
PSU	1000W Nzxt C1000 80+ Gold	$239
Mobo	Asrock X670E PG Lightning ATX AM5	$449
CPU	AMD Ryzen 9 7950X3D	$949
Cooler	Nzxt Kraken X73 RGB 360mm	$329
GPU	NEW **PowerColor Hellhound Radeon RX 7900 XTX 24 GB**	$1,599
RAM	64GB (2x 32GB) Corsair Vengeance DDR5 CL40 @ 5200MHz	$279
SSD	2TB WD Black SN850X M.2 PCIe 4.0	$309
HDD	6TB WD Blue 5400 HDD	$179
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60

INTEL BUILD - Approximate Price $5,641

Case	Phanteks Enthoo Pro 2 Tempered Glass	$299
PSU	1000W Corsair RM1000x Shift 80+ Gold	$239
Mobo	Gigabyte Z790 UD AC ATX LGA 1700	$339
CPU	NEW **Intel Core i9-13900KF**	$879
Cooler	Nzxt Kraken X73 RGB 360mm	$329
GPU	Zotac GeForce RTX 4090 Gaming Trinity OC 24GB	$2,729
RAM	64GB (2x 32GB) Corsair Vengeance DDR5 CL40 @ 5200MHz	$279
SSD	2TB WD Black SN850X M.2 PCIe 4.0	$309
HDD	6TB WD Blue 5400 HDD	$179
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60

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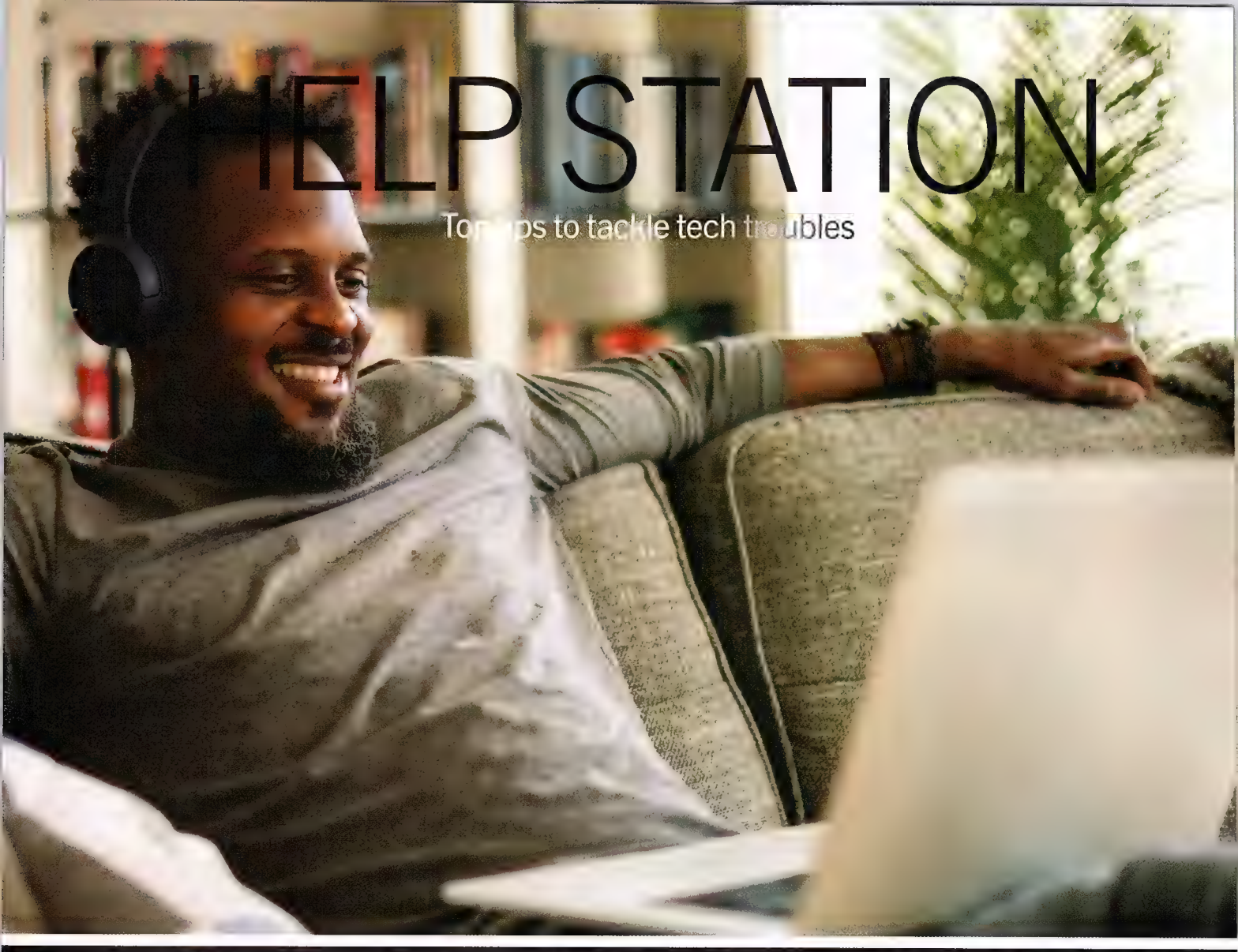
Building on the success of the Australian Hi-Fi Show 2023



HELP STATION

Tor ips to tackle tech troubles

Build your own Spotify for free

Nik Rawlinson explains how to break free from Spotify's monthly bills by running your own free music server that works with Alexa.

One of the best uses for a smart speaker is as an on-demand jukebox. Amazon's Echo devices integrate directly with both Spotify and Amazon's own online music service, each of which offers a library of more than 100 million tracks. So you should be able to find almost everything you want.

There are downsides to this arrangement, however. One is that you need to pay a subscription to get the best from these music services. On both Spotify and Amazon Music, free users can only request playlists, rather than specific songs; Amazon Prime subscribers can stream individual tracks from Amazon Music, but the service limits the number of times you can skip every hour, and insists on shuffling albums and playlists. For full control you need to pay $12.99 a month for a full Spotify Premium account, or $12.99 a month for Amazon Music Unlimited.

Another catch is that, as we said, you can find almost everything you want on these services. But what about those rare bootlegs and B-sides that you've been painstakingly collecting? Or recordings of your friends' bands, and your own mixes? Curating your own music library is unfashionable these days, but it's the best way to keep full control of your music, with all the tracks you want to listen to and no recurring payments.

The good news is that it's perfectly possible to get Alexa to stream your own music: you simply need to use the right software to make your tracks available over the network. A great free solution is Plex Media Server (and it also happens to handle video streaming as well). Here's how to set up Plex in Windows, and – our preferred solution – how to run it on an inexpensive, low-power Raspberry Pi computer.

"Plex tries to make your media available not just over your home network, but across the internet"

Setting up Plex Media Server on Windows

The first thing you need is a free Plex account. To create one, point your browser at plex.tv and click "Sign up". Log in with Google, Facebook or Apple, or create a standalone Plex account with your email address and a password; then click "Create an Account". You can subscribe to Plex's premium services at a later date if you wish, but for our purposes a free account is fine.

As well as music services, Plex integrates with a range of video-streaming platforms, including Amazon Prime, Apple TV+ and Netflix. When you first sign in, it offers to add them to your player; you can connect them to your account now, by selecting them in the list, or just close the streaming services dialog box.

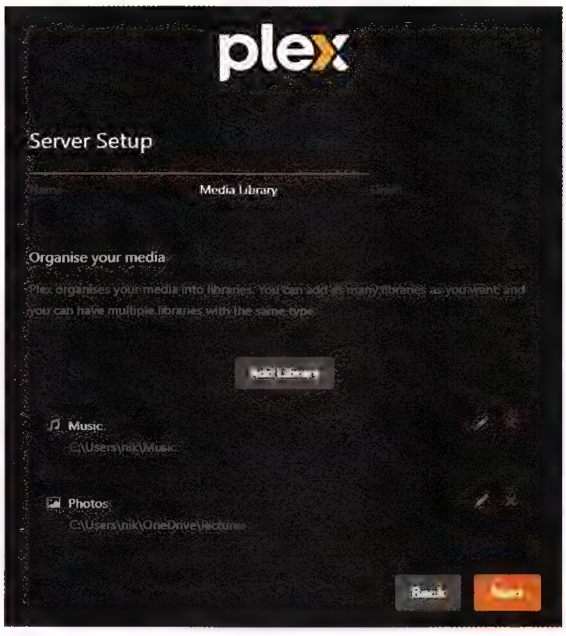
Having created your account, you next need to install the server software, which runs in the background and makes your tracks available to playback devices. Click "+ Your Media" in the sidebar, followed by the "Get Plex Media Server" button. You can alternatively install the server application from the Microsoft Store at **tinyurl.com/APC526plex**.

Once the download completes, step through the installation process and start the server. The setup wizard then launches to walk you through the process of adding media to your library. This doesn't involve actually moving any files, just adding their details to Plex's database.

The setup wizard will also ask if you want to synchronise your watch state and recordings. If you do, any ratings you apply to songs, TV shows or movies will be replicated across all devices logged in to the same account. It's up to you what you pick here.

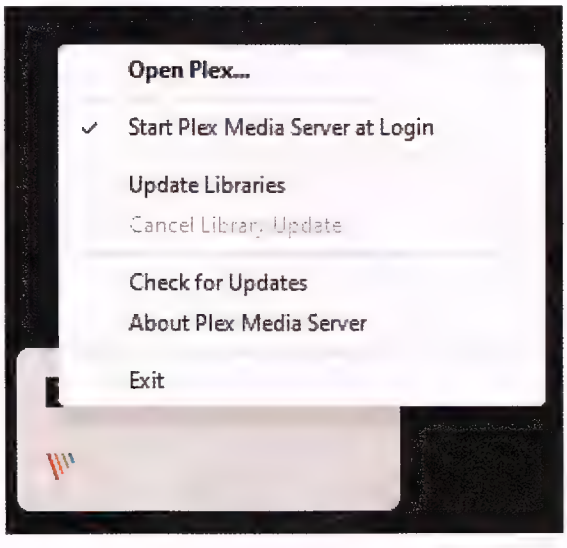
The next screen explains how the system works; click "Got It", then give your library a name. By default, Plex uses the name of your computer, but if several people use the same PC, it might make sense to use your own name.

By default, Plex tries to make your media available not just over your home network but across the internet, so you can listen on any device, anywhere in the world, as long as it's signed into your Plex account. Leave this option ticked; if you later find that external access isn't working, check that your firewall allows access to the main Plex port, which is TCP port 32400. Other ports worth checking include UDP ports 1900, 5353, 32410, 32412, 32413 and 32414, and TCP ports 8324 and 32469. For further details, Plex's help page on the subject is at **tinyurl.com/APC526plex2**.



ABOVE You can create multiple libraries for various media types.

Now click Next, and decide which libraries you want to make accessible through your server. Music and Photos may be selected by default, and already pointing to the music and photos folders on your PC. You can get rid of any libraries you don't want by clicking "X" to remove them, or edit their media locations by clicking the pencil icon.



BELOW If your libraries aren't refreshing, force an update from the taskbar icon.

If you want to share other types of media, click Add Library and navigate to the folder where the items are located. Don't worry too much about the contents of your media folders at this point – you can add as much content as you like later on. Once you're happy with your Library configuration click Next, followed by Done.

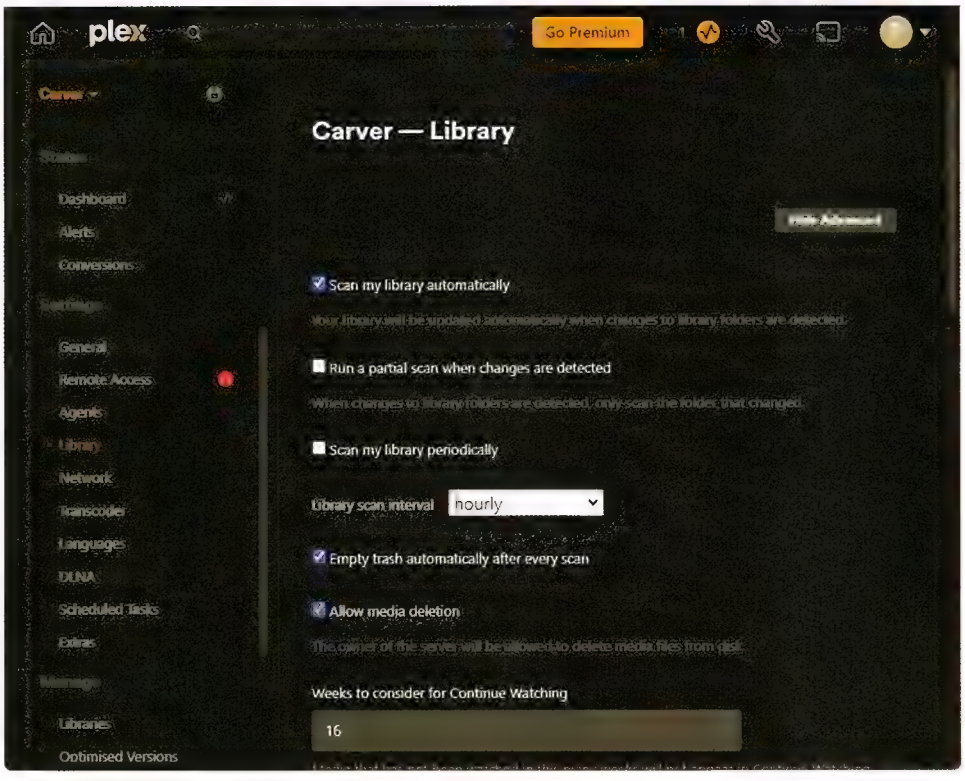
Plex Media Server will now start cataloguing your media. To browse the music it's discovered, click More in the sidebar, followed by the Music link at the top of the following sidebar (the Music link further down takes you to the Tidal streaming service, rather than your own music).

If your library shows as empty, it may simply be that Plex hasn't scanned it yet. To force it to refresh its database, click the upward arrow in the Windows system tray to reveal your hidden icons; now right-click the Plex icon and select Update Libraries from the context menu. Plex will refresh its listing from each of your libraries and add what it finds to the Plex Media Server, with albums represented by their cover art.

Another possibility is that Plex hasn't been able to recognise the tracks in your library. The software does its best to identify music files from their paths and filenames, and it can even read embedded ID3, but you'll get the best results if you organise your tracks according to the preferred Plex arrangement. This uses a separate folder for each artist, with a subfolder for each album, EP or single, containing numbered tracks in MP3, AAC, FLAC, M4A or WAV format. For example, your library will probably contain something like the following:

Music\Toto\Toto IV\01 – Rosanna.mp3
Music\Toto\Toto IV\02 – Make Believe.mp3
Music\Toto\Toto IV\03 – I Won't Hold You Back.mp3

and so forth. You can find more information about Plex's file-naming conventions at tinyurl.com/APC526plex3.



ABOVE Ensure Plex is set up to refresh your libraries automatically.

It's also worth making sure that the system is set to scan your library locations for updates, so that any new files you add will automatically become available in Plex. To do this, click the Activity icon at the top of the screen (shown as a pulse inside an orange circle), then scroll down to the section that shows your server name and click Library. Make sure the box beside "Scan my library automatically" is ticked. To make sure nothing's been missed, you can also tick the box beside "Scan my library periodically" and select an interval from the dropdown menu on the line below.

Your Plex Media Server is now up and running, and you can find and play music files from any web browser by connecting to the computer running the server software on port 32400. For a computer inside your home network, the address might be something like http://10.0.0.44:32400.

You can also access the web interface over the internet; to do this, you simply need to ensure that your router is forwarding TCP port 32400 to the system running your Plex server. You can either browse to the external IP address of your router, or visit plex.tv, log in and select "Open Plex" from the dropdown menu. You can also connect from anywhere via the Plex mobile app for Android and iOS.

What about playing songs with Alexa? This is possible, too – but first you'll need to link your Plex and Alexa accounts (see "Connect your Plex account to Alexa", opposite). There's currently no official way to stream from Plex to a Google Home device using voice commands, but you can use the Plex mobile app to select music and stream it to any Chromecast-compatible receiver.

Setting up Plex Media Server on a Raspberry Pi

It may be convenient to run Plex on your regular Windows desktop, but it means your songs will only be available while the computer's powered on and awake. If you want an always-on server, that's an ideal role for a Raspberry Pi. You don't even need a recent Pi model if you only want to serve up audio, although streaming high-definition video is likely to overtax even the most powerful board. You may, however, want to use a USB hard drive to store your media files, instead of squeezing them onto an SD card.

The easiest way to get started with Plex on the Pi is to install the DietPi OS build (**dietpi.com**), rather than the default Raspberry Pi OS. This optimised version of Debian is preconfigured to run a wide range of services, including Nextcloud, Pi-hole, Kodi, WordPress and Plex.

This means you can get set up in just a few simple steps. Start by connecting your external drive to the Pi, then booting the DietPi image. Next, go back to your Windows machine, open a Command Prompt and connect to your Raspberry Pi via ssh, using the username "dietpi" and the board's IP address. In our case, the command is:

```
ssh dietpi@10.0.0.50
```

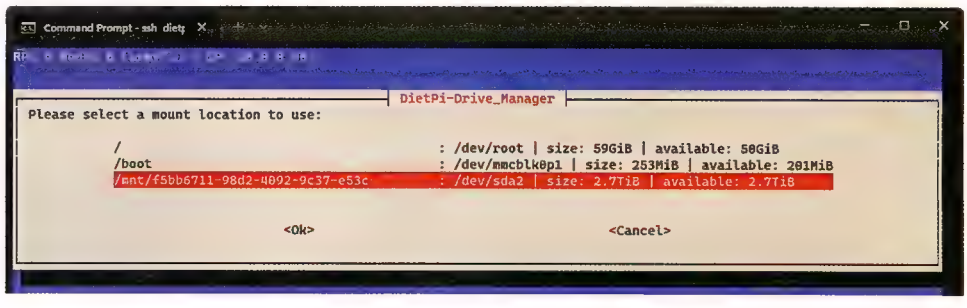
Once you've logged in, you'll arrive at a Linux command prompt. Enter:

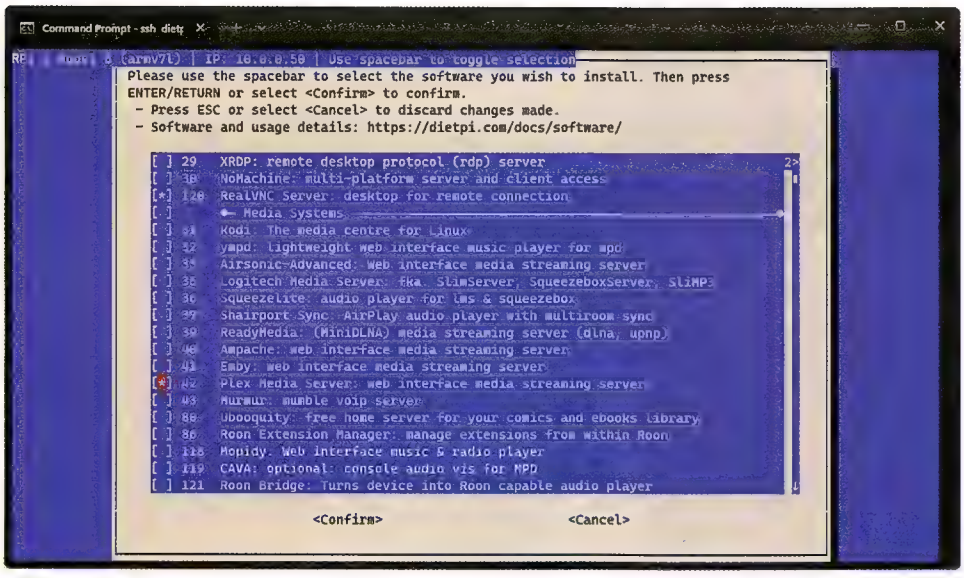
```
sudo dietpi-software
```

The first thing to do here is configure the Pi to use the USB drive for data storage, rather than the internal SD card. To do this, key down to "User Data Location" and press Return, then select "List" and press Return again. Select your attached drive and press Return. This records the change and returns you to the previous screen.

Next, key up to "Browse Software" and press Return to open the full list of applications that come bundled with DietPi. Scroll down through the list until you come to item "42: Plex Media Server". Press Space to select it.

BELOW Rather than filling up your SD card, attach an external hard drive.


Command Prompt - ssh dietp
DietPi-Drive_Manager
Please select a mount location to use:
/ : /dev/root | size: 59GiB | available: 50GiB
/boot : /dev/mmcblk0p1 | size: 253MiB | available: 201MiB
/mnt/f5bb6711-98d2-4092-9c37-e53c : /dev/sda2 | size: 2.7TiB | available: 2.7TiB
<Ok>
<Cancel>


Command Prompt - ssh dietp
Please use the spacebar to select the software you wish to install. Then press
ENTER/RETURN or select <Confirm> to confirm.
- Press ESC or select <Cancel> to discard changes made.
- Software and usage details: https://dietpi.com/docs/software/
[ ] 29 XRDP: remote desktop protocol (rdp) server
[ ] 30 NoMachine: multi-platform server and client access
[*] 128 RealVNC Server: desktop for remote connection
Media Systems
[ ] 84 Kodi: The media centre for Linux
[ ] 32 ympd: lightweight web interface music player for mpd
[ ] 34 Airsonic-Advanced: Web interface media streaming server
[ ] 35 Logitech Media Server: fka: SlimServer, SqueezeboxServer, SliMP3
[ ] 36 Squeezelite: audio player for lms & squeezebox
[ ] 37 Shairport Sync: AirPlay audio player with multiroom sync
[ ] 39 ReadyMedia: (MiniDLNA) media streaming server (dlna, upnp)
[ ] 40 Ampache: web interface media streaming server
[ ] 41 Emby: web interface media streaming server
[*] 42 Plex Media Server: web interface media streaming server
[ ] 43 Murmur: mumble voip server
[ ] 88 Ubooquity: free home server for your comics and ebooks library
[ ] 86 Roon Extension Manager: manage extensions from within Roon
[ ] 118 Mopidy: Web interface music & radio player
[ ] 119 CAVA: optional: console audio vis for MPD
[ ] 121 Roon Bridge: Turns device into Roon capable audio player
<Confirm>
<Cancel>

While we're here, let's also install DietPi's file-management tool, as this will make it easier to organise your media library. Scroll down again until you get to "198: File Browser", and again select it by pressing Space. Press Tab to highlight "Confirm", and press Return to go back to the previous screen. To confirm the installations you've just selected, key down to "Install" and press Tab (which selects "OK"), then press Return to deploy the selected software.

Once this is done, you should be able to log into Plex via a browser in just the same way as on a PC. Open a browser on any other computer on your network, and enter the IP address of the board, with ":32400" appended to specify the Plex port. When you get there, sign in using your existing Plex credentials.

You'll now be walked through the same setup process as outlined above, including giving your server a name and setting up the libraries you want to make available. There's one key difference, though. When creating a media library, you'll be presented with a "Browse for Media Folder" button; don't click this, but instead, click in the address box and enter:

/mnt/dietpi_userdata/Music/

This is the address of the default Music folder that's created by the File Browser as part of its installation process. Note the capital M, which is important: Linux-type operating systems are case-sensitive.

You can now click through the rest of the installer until you reach the familiar Plex interface. Click the activity icon at the top of the screen and select your server; click "Library" in the sidebar and make sure "Scan my library automatically" is ticked. Now scroll to the bottom of the screen and click Save Changes.

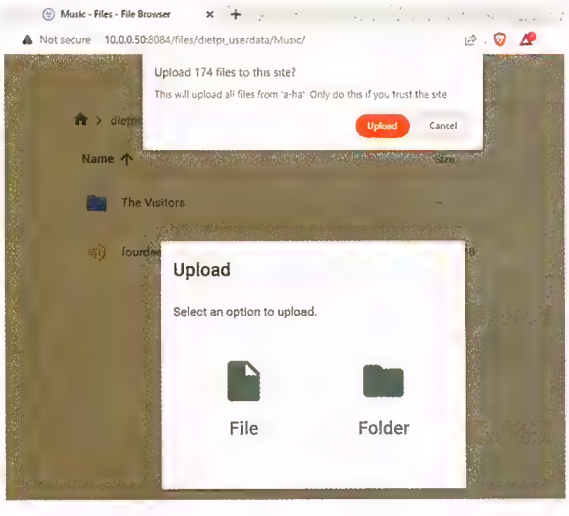
All that remains is to copy your files onto the USB drive. To do this, open a new browser on your Windows machine and navigate to your Pi's IP address, followed by port 8084 – in our case that would be 10.0.0.50:8084. Log in using the username dietpi, and your dietpi password.

Now click into the dietpi_userdata folder, and from there into Music. Click the up-pointing arrow at the top of the window, followed by Folder, to upload a complete folder. Select the folder you want to upload to the server, then click Upload to confirm the transfer.

If Plex doesn't immediately catalogue your new tracks, return to the Plex Media Server interface, hover over your music library in the sidebar, and click the three vertical dots to the right of its name. Click "Scan Library Files" on the fly-out menu. When Plex has updated its database, you should be able to play your tracks from the web interface, the mobile app – or, once you've linked your accounts, through Alexa. ■

ABOVE Plex Media Server is included in the DietPi application bundle. **RIGHT** The media server may warn that it's not being hosted by Plex.

BELOW You can upload tracks to the server using the File Browser app.



CONNECT YOUR PLEX ACCOUNT TO ALEXA

Once you've got your Plex server running on your network, you simply need to connect it to your Alexa account to make its content available. To do this, open the Alexa app on your phone and tap More, followed by "Skills & Games". Use the box at the top of the screen to search for "Plex". Tap the result, then tap the "Enable to Use" button.

The app will then switch to your browser, load the Plex website and prompt you to log in. Once you've done this, you'll be asked if you want to authorise Amazon Alexa to access your Plex account; tap "Authorise", followed by "Close".

There's nothing more to configure: you can now close the Alexa app, and start streaming your songs, albums and playlists by saying "Alexa, ask Plex to play..." Your requests are passed straight through to Plex, so any new files or playlist updates will be instantly available as soon as they're indexed.

The problem solvers

The *APC* team field problems across the spectrum of devices and software. Learn a new trick or fix you can use.

Home server advice

I'm planning to build a replacement home server. My current server is on its last legs: a 4th gen Intel i7 CPU on an ITX Asus board running Windows Server 2012 R2 Essentials. My server is used to back up my and my wife's laptop, plus run a Plex server.

I need one that's more modern and accessible online. I would like to stick with an ITX board and Windows Server, since I am familiar with it. Some of my mandatory requirements are: four or more SATA slots for 20TB of storage; the latest generation CPU that isn't a power hog; two NVME slots – one for the OS, and another for a scratch disk cache for Plex; 32GB RAM, and a possible Blu-ray burner. Wireless isn't required, as my home is covered with Cat 5e cabling.

I'd like to run one of the latest Windows Server Lite editions that allows remote access and a web address. I have family photos stored on the server, and usually give access to family members – the grandchildren use it to store artwork for example.

I started my love of servers after reading an article about the HP MediaSmart Server in your mag many years ago. It saved my bacon when my wife was going for her BSN and her laptop HDD failed. I was able to buy a new HDD, and within 90 minutes I was able to restore her laptop to the position it was in the night before the failure. My wife is an oncology nurse with 40+ years of experience.
Ray Fletcher

APC Responds: You could achieve most of what you need with a low-powered DIY Ubuntu Server. However, your NVMe requirements rule out our favoured low-powered choice: the Asrock J5040-ITX. It also means that you'll have to shop in the CPU range where the TDP is 65W, not a mere 10W, as found with the Pentium Silver range.

The key choices here are CPU and ITX motherboard. The 13th generation Intel Core i3 or i5 family will be your best bet when it comes to CPU, which means you'll need an LGA1700 ITX motherboard. We featured MSI's MPG Z790I Edge Wi-Fi Mini ITX board in our 'Mighty Micro PC' build in APC issue 523, and it ticks all your boxes, plus supports DDR5 RAM, but if the $499 price tag puts you off, take a look at its slightly less powerful sibling, the B760I Edge Wi-Fi, instead – the DDR5 version can be had for $429. The key differences are slower RAM (7200+ on the B760I, compared to 8000+ on the Z790I) and two M.2 slots instead of three, neither of which should be a problem. Get a breakdown of the differences between the two using MSI's comparison tool (**www.msi.com/Motherboards**).

The next question is which 13th-generation Intel chip do you pair with the board? In theory, Intel's T-series Core chips are the best for the job, because they offer a base TDP of just 35W. However, these chips are available on the OEM market only, so you're left sourcing regular chips instead. Of these, the Intel Core i5-13400 looks like a good choice. Although its TDP figures don't look that great compared to the T series (65W base, 154W Turbo), if your server is idling most of the time or running background tasks, then the CPU consumes next to no power thanks to four of the i5-13400's 10 cores being E (for efficiency) cores.

After selecting your motherboard and processor, the rest of your system (RAM, NVMe drives, and so on) will follow on, which leads us on to Windows Server. The Home version of this was discontinued a long time ago, and the current entry-level version – Windows Server 2022 Essentials – is only available through OEMs. This means you'll need to purchase Windows Server 2022 Standard, which has an eye-watering four-figure MSRP that will dwarf the cost of your hardware.

Now might be a good time to reassess what you need from your server – APC suspects you can achieve everything you want through a regular Windows install (or an Ubuntu Server), combining native sharing tools with third-party services to achieve what you want. Install Docker Desktop (**https://www.docker.com/products/docker-desktop**), and these services aren't just easy to set up and run, but can be made available over the internet via a suitable domain and reverse proxy like Nginx Proxy Manager.

Resurrect old Mac

A friend has just passed on an old MacBook Pro – 2016 vintage with Touch Bar – that runs well, but isn't supported by the latest version of macOS. What options do I have for keeping this running in the longer term when Apple stop providing any updates for the currently installled version (macOS 12, Monterey)?
Jennifer Escobedo

APC Responds: For now, you can keep your Mac running macOS Monterey with no major problems – most if not all existing software should run on it for as long as Apple support the release with patches and security updates. But guess what? You don't have to wait until Apple drops support for Monterey. Thanks to a tool called OpenCore Patcher (**https://dortania.github.io/OpenCore-Legacy-Patcher**), you can install a supported version of macOS (11 or later) on machines going back to 2007, and – more importantly – install the latest macOS 13 (Ventura) on your MacBook Pro.

It's simple to use – the app obtains a version of the macOS installer, then customises it to your Mac model before creating a bootable USB flash drive that you can use to install the latest version of macOS on to your hardware. It's worth reviewing the support for your specific OS, as some features are known to be

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broken due to incompatibilities with older hardware. The OpenCore Patcher team can fix some of these with updates, but others remain unpatched and can affect system stability. This tends to be with much older hardware; right now, there's no mention of any specific problems affecting your 2016 MacBook Pro.

Switch Linux desktop

I enjoyed Jonni Bidwell's feature on breathing new life into an old PC by installing Linux on it (*APC* issue 524). I went with the bog-standard Linux Mint install, but have struggled to get to grips with the desktop. What's the easiest way to preserve my settings and files before wiping the drive clean to try a different variant with another desktop?
Troy Beatty

APC Responds: While it's best practice to wipe your drive and start afresh with a new desktop, in most cases you can install two or more desktops side by side and switch between them. There can be glitches, though, meaning it pays to take a Timeshift snapshot before you begin so you can roll back easily if you hit trouble. It's also worth noting that desktops install their own apps like File Manager and Terminal client, so you'll end up with multiple shortcuts all doing the same thing.

APC recommends you try the desktop you want to switch to in a virtual machine like VirtualBox or from a live CD if one exists (check out Mint MATE or Mint Xfce editions) so that you don't end up installing loads of different desktops and breaking your installation.

Once you've settled on your new desktop, we recommend installing it through the Terminal after making sure your system is up to date ('sudo apt update && sudo apt upgrade'). For example, to install MATE:

$ sudo apt install mate-desktop-environment

Or to install Xfce:

$ sudo apt install mint-meta-xfce

Once the package has been installed, log out of your desktop. You'll see an icon appear to the right of your profile name on the login screen – click this, and you'll be given a choice of desktops. Select your new desktop, then log in. Look out for teething problems – on our test system, Xfce didn't display its Applications Start menu, which had to be manually added with other components by right-clicking the taskbar at the bottom of the screen and choosing Panel > Add New Items... Once added, right-click each item, and choose Move to reposition it.

Why no Windhawk?

I'm a long-time user of 7+ Taskbar Tweaker. Its website refers to a customisation tool called Windhawk that claims to restore some of the tools missing tweaks in Windows 11. Is it worth covering in more depth?
Norman J Youngs

APC Responds: We did look at Windhawk (**https://windhawk.net**) recently out of personal interest, intrigued by its tagline: "The customisation marketplace for Windows programs". But it's this attempt to build a centralised marketplace for third parties to distribute their own mods that appears to have been its undoing, because after installing it, Bitdefender immediately threw up an alert.

We dug a little deeper into both vscodium.exe – which turns out to be a free and open-source implementation of Microsoft's vscode repository – and Windhawk itself to determine why Bitdefender considered it a possible threat. VSCodium has frequently found itself flagged by anti-malware tools, but while we were able to determine that this appears to be a false positive, a wider search on Windhawk did raise legitimate concerns.

These are based around how Windhawk works: mods are basically snippets of C++ that get injected into other programs, which depending on your point of view is either a great, convenient way to build a series of mods, or a security nightmare. The developer has attempted to allay concerns on Reddit (**www.reddit.com/r/ReverseEngineering/comments/t9dd21/windhawk_the_customization_marketplace_for**), and it sounds like an interesting concept. If the developer can work out how to allay security concerns and avoid triggering antivirus alerts, we may revisit it. ■

MSI's MPG mobos are perfect for SFF servers.

Make Windows better

Expert tips for a better experience.

WINDOWS 11

Switch on Paint's new dark mode

Microsoft has updated Paint so you can set it to mirror your system's screen mode (light or dark), or make it appear in dark mode permanently.

Search for and open Paint. You'll know you're using the latest version if you see a gear icon (1 in our screenshot below) at the top right. Click this to see Paint's new settings menu. Now select Dark 2 in the 'App theme' options, and Paint will adopt the dark mode.

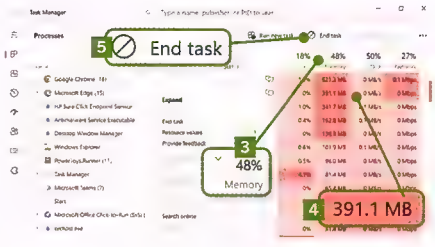
If you don't see the cog icon, you need to update to version 11.2304.30.0 (or later) of Windows 11. Do this by opening Windows Update in Settings and clicking 'Check for updates'.

WINDOWS 10 & 11

Stop processes from being reordered in Task Manager

If your system slows, check Task Manager to see whether you can close any background processes that are using too much RAM. This is an effective trick, but it can be hard to identify which process to close because Task Manager reorders them every second to reflect how much memory they're using.

To stop this happening, search for and open Task Manager. Next, click 'Memory' (3 in our screenshot below) to organise your apps by RAM usage. Now hold down the Ctrl key and the list will 'freeze'. In our example, Microsoft Edge was using 391MB 4, so we right-clicked it then chose 'End task' 5.



WINDOWS 11 INSIDER

Use your voice to log into Windows 11

In the final version of Windows 11 you have to wait until it has fully loaded before you can give spoken commands using 'Voice access'. A recent preview version (build 22631.2129) makes Windows respond to spoken commands before it has launched, meaning you can log in with your voice.

First, search for and open the Settings menu. On the left-hand pane, click Accessibility (6 in our screenshot above right) and scroll down until you see Speech under the Interaction options. In the Speech menu, set the 'Voice access' slider to On 7. When you do this, the voice access bar will appear at the top of your screen 8. Next, tick the box next to 'Start voice access before you sign in to your PC' 9.

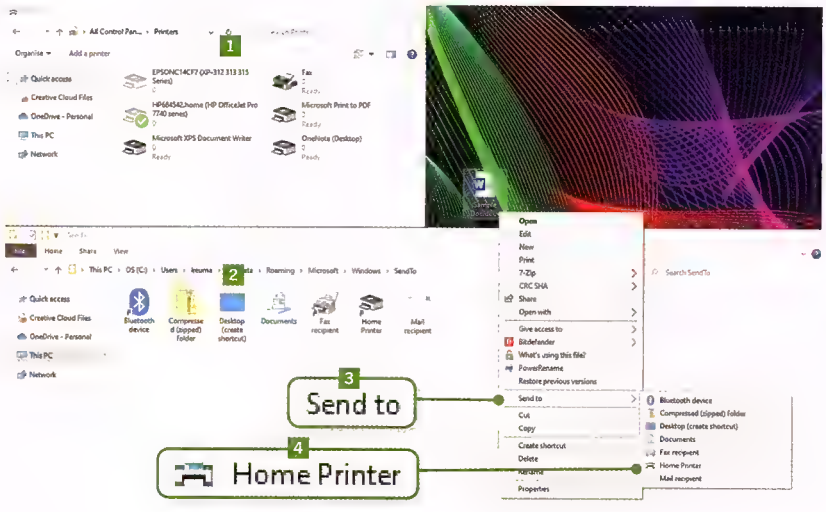
When you next encounter the lock screen, you can use voice commands to enter your PIN or password. If you're worried about being overheard, say "show keyboard". Windows will display an onscreen keyboard with a different number assigned to each key. Speak using these numbers, rather than spelling out your actual password. Visit Microsoft's site for more information on 'Voice access', including commands you can use: **www.snipca.com/47349**. ■

Windows 10 & 11 Add your printer as right-click option

To print a document in Windows, you must first open the file and access the Print menu. But you can save time by adding your printer as an option in the right-click context menu.

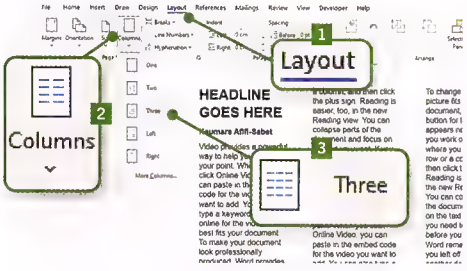
First, open two File Explorer windows. In one, type shell:PrintersFolder into the address bar; in the other, type shell:sendto. This will open the Printers (1 in our screenshot) and SendTo folders 2.

Next, drag and drop your printer icon from the Printers folder into SendTo. You can now see it by right-clicking the file you want to print, then selecting 'Send to' 3. You can also rename it – we chose Home Printer 4. Clicking it will send your document straight to the print queue.



Make Office better

Expert tips for a better experience



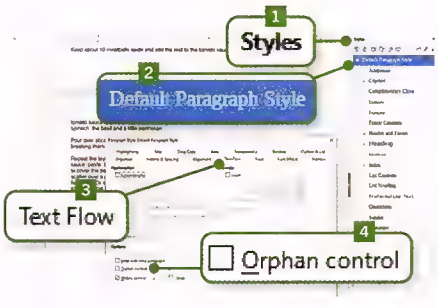
LIBREOFFICE WRITER & MICROSOFT WORD

Create columns in a document

By default, Word documents present text in a single column, with text flowing from left to right. But you can change this to two or more columns.

To add columns to your whole document, click the Layout tab (1 in our screenshot above), then Columns 2 and choose a format of your choice. In our example, we've chosen Three 3, as we want to style our document like a newspaper column.

To do the same in LibreOffice Writer, click Format at the top, then Columns. In the box that opens change the Columns value to the number you want, then click OK.



LIBREOFFICE WRITER

Turn off 'Orphan control' to avoid large gaps

When writing a document, you can use 'Orphan control' and 'Widow control' settings to make sure single lines don't appear at the top or bottom of a page when a paragraph spills from one page to the next. By default, these controls allow at least two lines of text to appear together, meaning three-line paragraphs can't be split. Instead, all three lines are moved to the next page, leaving a large gap at the bottom of the previous one.

Consider turning off orphan control to resolve this. First, press F11 to open the Styles side panel (1 in our screenshot above). Next, right-click Default Paragraph Style 2 and click 'Modify...'. In the box that opens, select the Text Flow tab 3 and under the Options heading untick 'Orphan control' 4. Click OK.

As a result, your three-line paragraph can now be split between two pages. You'll want to keep 'Widow control' active, though, to avoid the prospect of a single word appearing on the next line.

ONLYOFFICE

Use ChatGPT to generate text and images

You can now add the AI tool ChatGPT to OnlyOffice, so you can ask it questions or generate text and images based on prompts. First, click Plugins on the toolbar, then Plugin Manager. Search for 'ChatGPT' in the bar, then click the Install button when the plug-in appears.

To use ChatGPT, you must first register for a free trial with OpenAI at **www.snipca.com/47210**. Once you've created an account, you need to generate an OpenAI API 'key' through your account settings. Click your profile photo then select 'View API keys'. Now click 'Create new secret key' and give it a name by typing in the text field. Then click 'Create secret key' to confirm. Copy this code, then right-click anywhere in OnlyOffice, hover over 'ChatGPT' and click Settings. Paste your code into the text field, and press Save.

In our example, we generated an illustration based on the description 'a young fox running in a woodland environment'. We highlighted the text (1 in our screenshot above), then right-clicked it and selected 'Generate image from text' 2, then chose 512x512 pixels 3. After a few short seconds, ChatGPT created an illustration in our document 4. ■

Libreoffice Calc & Microsoft Excel

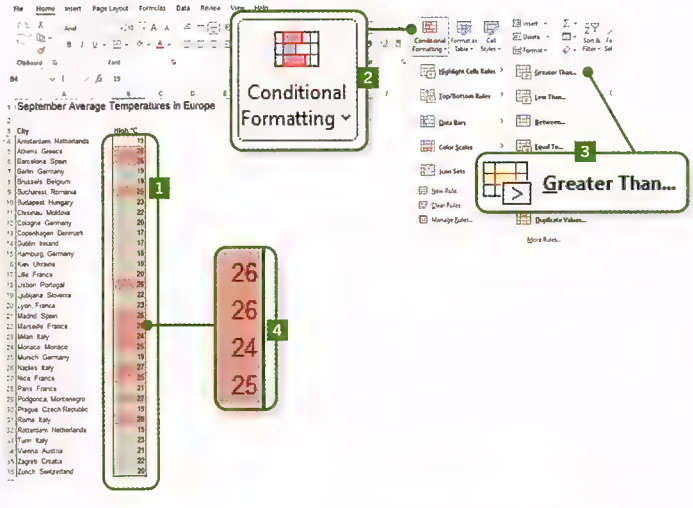
Use conditional formatting to colour-code cells

You can use conditional formatting to quickly colour-code your data, helping you to make sense of it more easily.

In our example, we're going to highlight temperatures above 23°C to pick out holiday destinations for September. You should be able to apply these instructions to your own data. First, we highlighted cells B4:B36 (1 in our screenshot). Then we clicked the Home tab followed by Conditional Formatting 2. We hovered over Highlight Cells Rules, then clicked 'Greater Than...' 3.

Next, in the box that appears, we set the value to 23 and chose the 'Light Red Fill with Dark Red Text' in the dropdown menu. We clicked OK to confirm. All cells above 23°C now appear in red 4.

You can also set conditional formatting in LibreOffice Calc. After highlighting a selection of cells, click Format at the top. Hover over Conditional, then click 'Condition...'. You can set your conditional-formatting rule in the box that appears.



Browser tips

Secret settings and best extensions

CHROME

Skip annoying CAPTCHAs on websites

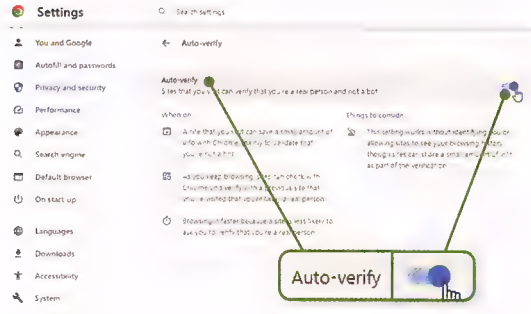
Chrome 116, which was released in August, adds the long-overdue option to stop websites asking you to prove you're human, either by completing a CAPTCHA or by clicking 'I'm not a robot'. Once you've passed one of these tests, the browser will store the confirmation so other sites can automatically verify that you're a real person and not a bot.

This new 'Auto-verify' feature should be enabled in Chrome by default, but it's worth double-checking. Click the browser's three-dot menu button and choose Settings, then 'Privacy and security'. Select 'Site settings' then 'Additional content settings' and click 'Auto-verify', ensuring that the option is switched on (see screenshot below).

Google says the setting works without identifying you or allowing sites to see your browsing history. It may not work on every website, but makes it "less likely" you'll be asked to prove your human status.

Chrome 116 also adds an experiment that lets you temporarily allow websites to access your location, camera or microphone. Currently, you can only choose Allow or Block, which means that if you change your mind later, you have to manually reset the permission. The new option lets you grant 'one-time' permissions, similar to the 'Only this time' option for Android apps, to protect your privacy from intrusive sites.

See our Workshop below to find out how to use the new permissions feature.



BRAVE

Delete cookies and site data automatically

Brave 1.57, released 16 August, introduces the browser's Forgetful Browsing feature. This prevents websites from remembering you visited them by logging you out and deleting their cookies and other stored data when you close their tabs.

The feature has been renamed 'Forget by Default' and you no longer need to unlock it by enabling a hidden experiment. Instead, just click the Shields (lion head) button on Brave's toolbar and switch on the option 'Forget me when I close this site' (see screenshot left). This will sign you out and delete all cookies and other data after you close all tabs showing pages from the current site.

To enable 'Forget by Default' for every site you visit, click Brave's three- line menu button, choose Settings, then Shields, and switch on the 'Forget me when I close this site' option. You can disable the feature on specific sites (to stop them logging you out and deleting cookies) by clicking the Shields button and switching the option off.

Visit **brave://settings/content/all** to confirm that 'Forget by Default' is wiping stored data when you leave a site (some unremovable cookies may remain).

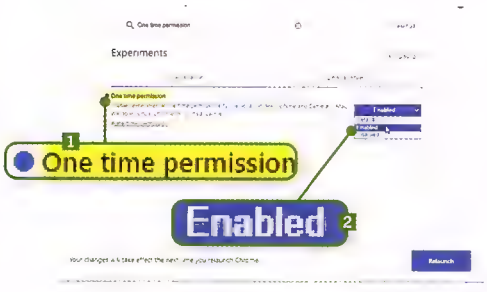
EDGE

Perform browser actions using Bing Chat

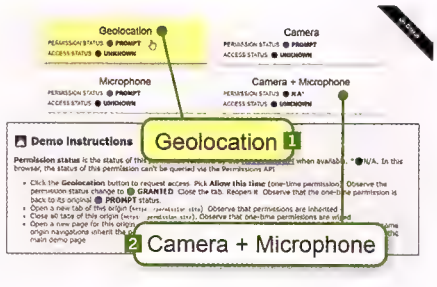
We were initially sceptical about the Bing Chat feature in Edge, after Microsoft foisted the AI tool on users earlier this year. But having Bing Chat in the browser's sidebar does have its uses, such as asking it to perform certain actions in Edge.

For example, you can ask Bing Chat to open your Downloads page, switch to vertical tabs and clear your browsing data (see screenshot right), simply by typing the relevant command into the

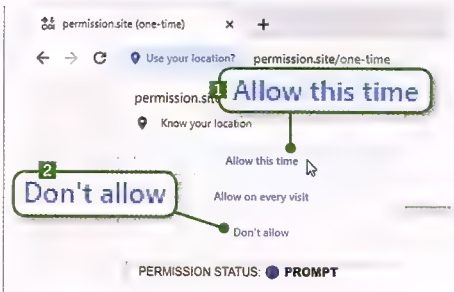
Workshop Grant one-time site permissions in Chrome



To activate Chrome's new permissions feature, type **chrome://flags** into the address bar and press Enter to load the Experiments page. Find the entry One time permission 1, select Enabled in its dropdown menu 2 and relaunch the browser.



When Chrome reopens, you can test the new feature by visiting the one-time permissions demo site at **www.snipca.com/47331**. Click one of the buttons on the page: Geolocation 1, Camera, Microphone or 'Camera + Microphone' 2.



Chrome will now display its new permissions prompt. Click 'Allow this time' 1 to grant the demo site a one-time permission to access your location, camera and/or microphone. You can also choose 'Allow on every visit' or 'Don't allow' 2.

Best extension for... Refreshing web pages automatically

AUTO REFRESH PLUS

Chromium | www.snipca.com/47341

When you're eagerly waiting for content on a web page to update - for example, to check the delivery status of a parcel or buy tickets for an event - it's very tedious having to keep clicking your browser's Refresh or Reload button. This extension does the hard work for you, by automatically refreshing the page at a time interval of your choice.

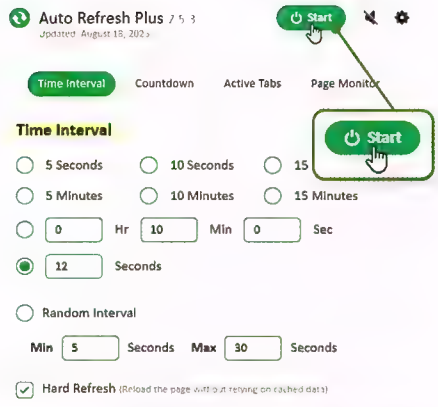
Simply click its toolbar button to specify how frequently to reload the current web page, then click Start (see screenshot). You can optionally show a countdown timer in your toolbar and decide between a 'soft' refresh, which uses cached data to load content, or a 'hard' one, which reloads everything from scratch. Click the Page Monitor tab to have Auto Refresh Plus alert you when specific text appears on a page.

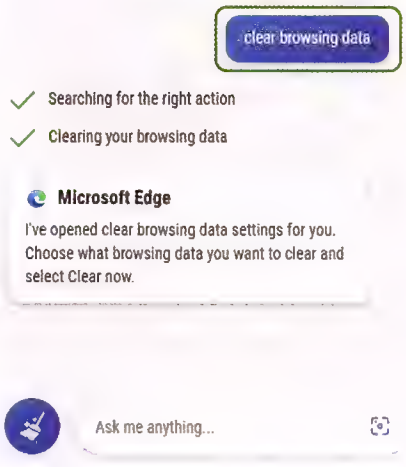
IF YOU DON'T LIKE THAT, TRY...

AUTO REFRESH PAGE

Firefox www.snipca.com/47342

This add-on works in the same way as Auto Refresh Plus, but for pages in Firefox. Set your refresh time interval then click the Start button.




clear browsing data
Searching for the right action
Clearing your browsing data
Microsoft Edge
I've opened clear browsing data settings for you. Choose what browsing data you want to clear and select Clear now.
Ask me anything...

chat box. Some tasks require further confirmation, but it's a useful trick if you don't know where to find a particular feature or setting.

It also turns Bing Chat into an accessibility tool, allowing people who have trouble using their mouse to perform browser actions using their keyboard instead. There's a slight pause while it processes your request, but the feature generally works well.

FIREFOX

Translate web pages when you're offline

Firefox's new translation feature brings the browser in line with Chrome and Edge by letting you translate entire web pages without needing an extension. Firefox 117, released at the end of August, officially introduces the feature (you previously needed to enable it manually), so you can instantly translate foreign-language content into English.

When you're viewing a foreign website, click the new 'Translate this page' icon at the end of the address bar, and Firefox will detect the source language and translate it into English. To automatically translate pages in that language, click the cog in the top-right corner of the Translate box and choose 'Always translate [language]'.

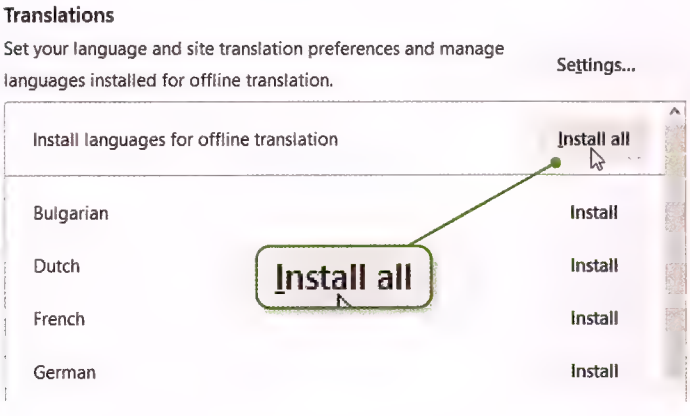
The feature currently supports 18 languages, including Dutch, French, German, Italian, Portuguese, Spanish and Ukrainian, and lets you translate them offline by installing the relevant language pack. Click Firefox's three-line menu button and choose Settings, then General. Scroll down to the Translate section and either click the Install button next to the language you want to translate offline, or click 'Install all' (see screenshot bottom left).

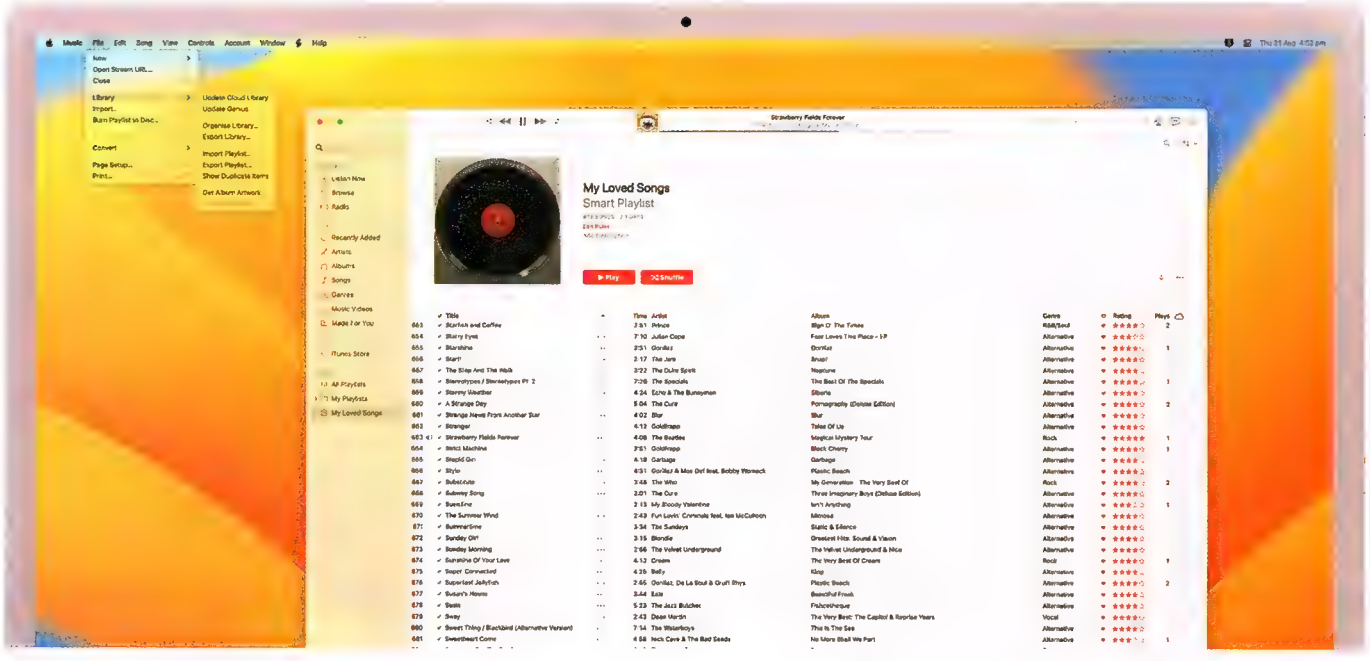
CHROMIUM

Restore the Twitter logo and Tweet button

One consequence of Elon Musk rebranding Twitter as X is that the distinctive bird logo (nicknamed 'Larry') has been ditched in favour of the eponymous letter.

A new extension called 'Freebird – X' (**www.snipca.com/47340**) offers justice for Larry by restoring the blue bird to the social network. Once installed, it replaces all instances of the new X logo with the classic Twitter design (1 in our screenshot left) – including the favicon that appears in browser tabs, which are now labelled Twitter rather than X. It also switches the new Post button back to Tweet 2, and brings back the Retweet option Musk removed, without affecting the site's functionality. ■





Fix duplicates in Apple Music

Clean up your Music library with these top tips for the Mac app.

IT WILL TAKE
20 minutes
YOU WILL LEARN
How to identify and manage duplicates in your Music library
YOU'LL NEED
macOS 10.15 or later, Music app

No matter how carefully you curate your music collection, you're bound to end up with all kinds of duplicates – and it's not your fault! Artists often release songs first as singles and then on albums, before they eventually turn up on greatest hits collections, movie soundtracks and chart hits compilations. And then there are the live versions, recordings made specially for radio broadcasts and all those ones that have popped up on the Apple Music playlists you've downloaded.

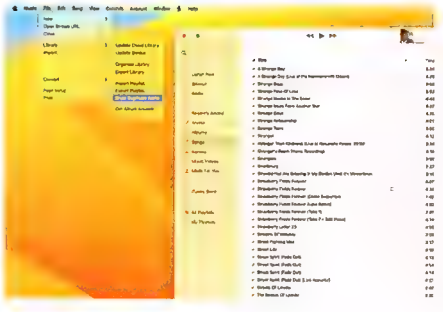
If you're getting tired of having 17 different versions of the same Ed Sheeran song on your Mac, iPhone and iPad we sympathise – and we're here to help!

In this tutorial, we'll show you to identify duplicates tracks in the Music app for Mac, how to remove them or mark them as superfluous, and how to preserve the versions you do want to keep without hearing Shape Of You (Single), Shape of You (Live) and Shape Of You (Remix) one after the other... **Rob Mead-Green**

How to Manage duplicates in your Music library

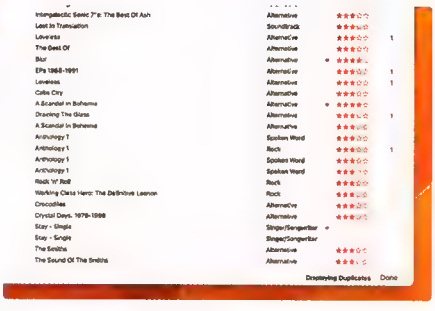
1 Sort alphabetically

One way to find duplicates in your Music library is to select Songs in the sidebar, then click Titles at the top of the main window. The songs in your library will now be sorted alphabetically, so you can see tracks with a similar name.



2 Show duplicate items

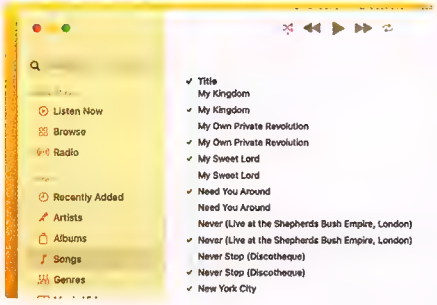
But there is also a smarter way. Go to File > Library > Show Duplicate Items, and the main window will show you an updated list containing the songs that the Music app has identified (using the files' metadata) as being identical.



3 Examine duplicates

The 'Displaying Duplicates' label at the bottom right of the Music window shows that you're now only viewing true duplicates. To exit this view without doing anything, click Done. But we're going to have a little tidy-up first...

Continued... How to Manage duplicates in your Music library

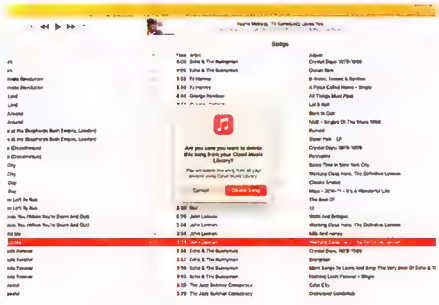


4 Sound check

Before wading in and randomly deleting tracks, begin your clean-up by using the checkboxes to the left of each song title. Unchecking a song will prevent it from playing, but it won't remove it from your library.

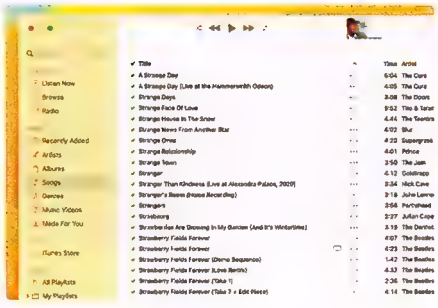
5 Decision time

Here we've chosen to uncheck duplicate tracks found on compilation albums, greatest hits collections, singles and EPs, while preserving album tracks – but you don't have to manage your duplicates this way.



6 Keep or delete?

While unchecking a duplicate will stop it playing, the physical file will still exist on your Mac and/or in your iCloud Music Library. To remove it, press Delete. Read the warning dialog, and, if you're happy to proceed, click Delete Song.



7 Manage similar files

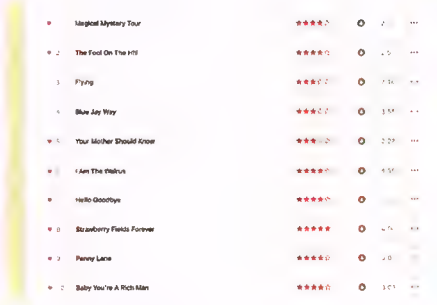
Whatever you decide to do about exact duplicates, the chances are you still have lots of similar music files in your library. Here you can see we have six different versions of Strawberry Fields Forever by The Beatles. Hmm...

8 All you need is love

While we want to keep these different versions, and listen to them on occasion, we don't necessarily want them popping up multiple times in any playlists we create. One option would be to 'love' a particular track to mark it as special.

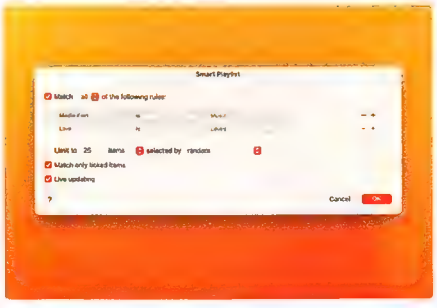
9 Love is all you need

To 'love' a track you can either right-click it and select Love from the drop-down that appears (see step 8) or choose Song from the menu bar and pick 'Love' that way. Another way to favourite a track is to give it a star rating.



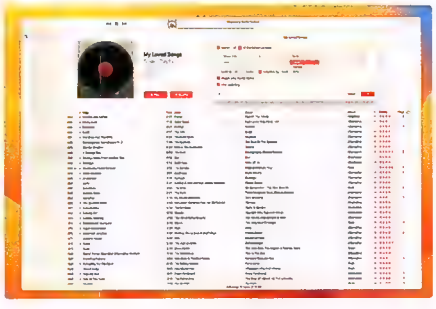
10 It's in the stars

While 'Love' is Apple's preferred method for favouriting a track, star ratings offer more granularity. Here we've given five stars to our favourite version of Strawberry Fields Forever, shown here in Music's Album view.



11 Love smart playlists!

Choosing favourite versions makes the most sense when you're creating smart playlists. Here we're creating a rule that says only songs we have 'loved' can be included in a playlist. This is the playlist we're going to sync to our iPhone.



12 Silly love songs

Here's the playlist! To create a smart playlist, go to File > New > Smart Playlist. We've used the 'Love is Loved' rule and made sure 'Match only ticked items' is selected. That way any items we unchecked in step 4 won't be included. ■

Bring your images and videos to life

Not known for his love of cameras, Shashank Sharma still knows how to turn images into presentable GIFs and video clips into masterpieces.

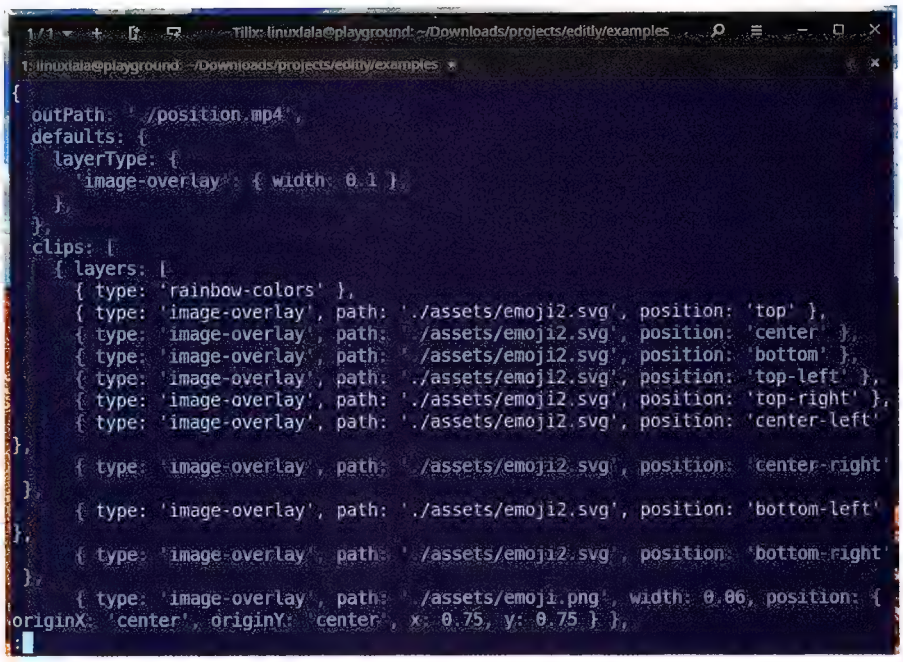
Remember the good ol' days of the internet when the best you could do with your pics and videos was share them with friends and family? Close ones at that. This is in stark contrast to the modern-day practice of turning everything into a reel or insert-latest-jargon-here, and releasing it online.

Editly is a CLI utility that relies on FFmpeg to help you create slideshows, GIFs or movie masterpieces, complete with music score, text overlays, zooms and other effects. Best of all, you don't have to muck about with the terminal pushing dozens of different settings, because Editly works with a JSON file instead to save you time and effort. Whether for private use or for internet fame, Editly can help turn your images and videos into memorable pieces with very little effort.

Released under the MIT License, you won't find Editly in the software repositories of popular desktop distros. As well as FFmpeg and FFprobe, which are most likely already installed on your distro, and in any case available in the software repositories, you also need the GL utility (**https://github.com/stackgl/headless-gl**), which has its own set of requirements, listed at the project's GitHub page.

While you're at it, you should also install the NPM package manager. Use the `sudo apt install npm` command if you're on a Deb-based distro such as Debian or Ubuntu, or run `sudo dnf install npm` for RPM-based distros.

> "Editly is a CLI utility that relies on FFmpeg to help you create slideshows, GIFs or movie masterpieces, complete with music score, text overlays, zooms and other effects."


Tilix: linuxdala@playground: ~/Downloads/projects/editly/examples
1: linuxdala@playground: ~/Downloads/projects/editly/examples
{
outPath: './position.mp4',
defaults: {
layerType: {
'image-overlay': { width: 0.1 }
},
},
clips: [
{ layers: [
{ type: 'rainbow-colors' },
{ type: 'image-overlay', path: './assets/emoji2.svg', position: 'top' },
{ type: 'image-overlay', path: './assets/emoji2.svg', position: 'center' },
{ type: 'image-overlay', path: './assets/emoji2.svg', position: 'bottom' },
{ type: 'image-overlay', path: './assets/emoji2.svg', position: 'top-left' },
{ type: 'image-overlay', path: './assets/emoji2.svg', position: 'top-right' },
{ type: 'image-overlay', path: './assets/emoji2.svg', position: 'center-left' },
{ type: 'image-overlay', path: './assets/emoji2.svg', position: 'center-right' },
{ type: 'image-overlay', path: './assets/emoji2.svg', position: 'bottom-left' },
{ type: 'image-overlay', path: './assets/emoji2.svg', position: 'bottom-right' },
{ type: 'image-overlay', path: './assets/emoji.png', width: 0.06, position: {
originX: 'center', originY: 'center', x: 0.75, y: 0.75 } },

Working with JSON files may seem counter-intuitive at first, but it doesn't take long to get used to.

Unless you're on a rolling release distro, such as Arch, the version of FFmpeg available in the software repositories of your distro is somewhat dated, and therefore unfit for use with Editly. Refer to Installation Is A Chore (opposite), for instructions on how to get a compatible version of FFmpeg. With all that done, you're ready to install Editly. Run `npm install -g editly`.

Start writing

Writing is a curious word to use when working with a tool designed to help transform images and video files, but that's precisely what Editly expects you to do. You can use the project to create appealing videos using solid colours as you transition from one video to the next, or use images overlaid with text between different video clips. You can also add custom background music to the finished video file or generate a GIF from a series of images. The tool additionally supports effects such as blur, fade-in and so on, which you can use to define how one image or video transitions to the next in the final video.

All such operations that you wish to perform, such as fading out of the first image and zooming into the next, while music plays in the background and different text is written over each image, are written into a JSON file, which Editly then uses to carry out your instructions.

For instance, let's use a couple of images from a recent holiday and stitch them together into a video file:

```
{
  width: 600,
  height: 300,
  outPath: './images-to-video.mp4',
  defaults: {
    transition: null,
    duration: 1.2,
  },
  clips: [
    { layers: [{ type: 'image', path: './
IMG_20190805_130342931.jpg' }] },
    { layers: [{ type: 'image', path: './
```

INSTALLATION IS A CHORE

Unless you're running a rolling release distribution, such as Arch Linux, you likely have an older, incompatible version of FFmpeg. This leaves you with two options.

First is to manually compile a recent release of FFmpeg, which can be quite a cumbersome task, more so because we don't have room enough to go over the steps in this tutorial. Thankfully, you can head over to FFmpeg's homepage, where you'll find detailed instructions on compiling it.

The second option is to retain the version of FFmpeg you already have available, and grab the static release of FFmpeg from the project's website. This is designed for users who don't wish to go through the trouble of manually compiling FFmpeg. Head to **https://johnvansickle.com/ffmpeg/** and grab the version that best suits you. You can opt for the latest 6.0 release or the master branch. Extract the tarball with the `tar xvf ffmpeg-release-amd64-static.tar.xz` command. Now navigate into the extracted directory and place the comprising FFmpeg and FFprobe binaries into a directory within your $PATH.

If you've decided to retain the current version of FFmpeg, make sure to first run the `which ffmpeg` command, and place the extracted binaries in a directory in $PATH, which will be scanned before the directory the contains the installed FFmpeg:

```
$ which ffmpeg
/usr/bin/ffmpeg
$ echo $PATH
/home/linuxlala/.cargo/bin:/home/
linuxlala/.local/bin:/usr/local/bin:/usr/
local/sbin:/usr/sbin:/usr/bin:/sbin:/bin:/
snap/bin:/usr/local/go/bin:/home/
linuxlala/go/bin
$ sudo cp ffmpeg ffprobe /usr/local/bin
```

```
IMG_20190805_130358474.jpg' }] },
 ],
}
```

Here we've created an MP4 file using two images, and we've defined certain parameters at the top, such as the width and height. Save this file as images-to-video.json5 and then run the `editly images-to-video.json5` command. You can now play the images-to-video.mp4 file in your favourite video player.

You can use a combination of image and video files, add text overlays and custom music files, and even use multiple music files for the same video clip.

To get a sense of some of the operations possible with Editly, open the terminal and clone the Editly directory from GitHub:

```
$ git clone https://github.com/mifi/editly.
git
$ cd editly/examples
```

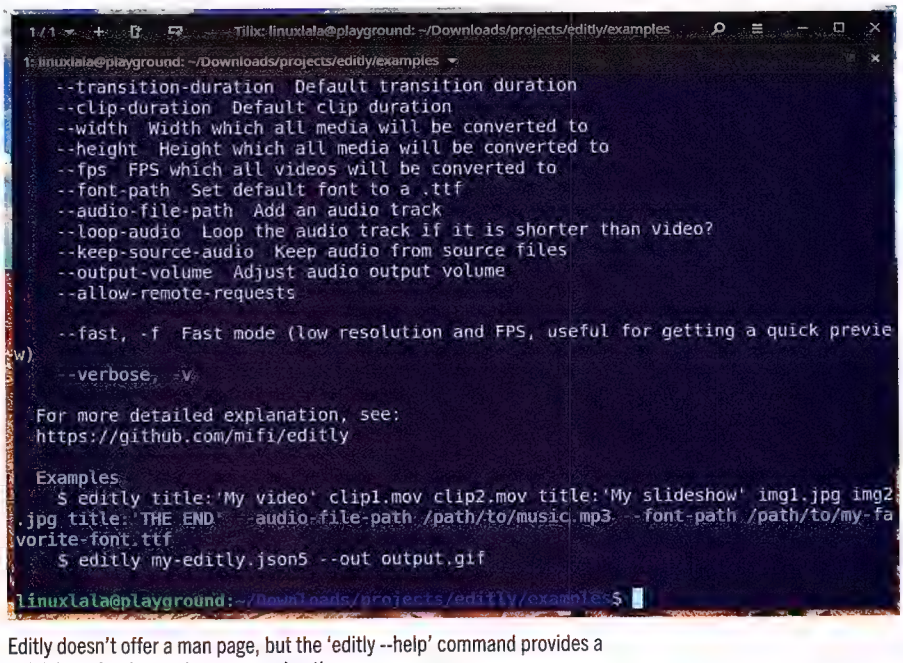
You can now read through the different JSON5 files in the examples directory to get a feel for how Editly works. To see any of the effects in operation, run the `editly <filename.json5>` command, which creates an output file of the same name. You can then play the file to see the effect.

```
{
 // verbose: true,
 // enableFfmpegLog: true,
 outPath: './video2.mp4',
 defaults: {
   transition: {
   name: 'linearblur',
   },
   layer: { fontPath: './assets/Patua_One/
PatuaOne-Regular.ttf' },
 },
 clips: [
   { layers: [{ type: 'video', path: './assets/
changi.mp4', cutFrom: 0, cutTo: 2 }, { type:
'title', text: 'Video 1' }] },
   { layers: [{ type: 'video', path: './assets/
IMG_1884.MOV', cutFrom: 0, cutTo: 2 }] },
 ],
}
```

This example uses the linearblur transition and two different video clips to create the final file. If you only have a couple of video or image files to stitch together, you can even work with Editly without bothering with a JSON file – `editly title:'Masterpiece' vid1.mp4 vid2.mp4 --audio-file-path ./filename.mp3` , for example, uses two video files and a music file to create a stitched video file.

Should you run into any problems, you can use the Issues section on the project's GitHub page. Your own creativity and willingness to experiment are the only impediment to transforming your vanilla images and video clips into stunning visual masterpieces. ■

> "Writing is a curious word to use when working with a tool designed to help transform images and video files, but that's precisely what Editly expects you to do."


Tilix: linuxlala@playground: ~/Downloads/projects/editly/examples
1: linuxlala@playground: ~/Downloads/projects/editly/examples
--transition-duration Default transition duration
--clip-duration Default clip duration
--width Width which all media will be converted to
--height Height which all media will be converted to
--fps FPS which all videos will be converted to
--font-path Set default font to a .ttf
--audio-file-path Add an audio track
--loop-audio Loop the audio track if it is shorter than video?
--keep-source-audio Keep audio from source files
--output-volume Adjust audio output volume
--allow-remote-requests
--fast, -f Fast mode (low resolution and FPS, useful for getting a quick previe
w)
--verbose, -v
For more detailed explanation, see:
https://github.com/mifi/editly
Examples
$ editly title:'My video' clip1.mov clip2.mov title:'My slideshow' img1.jpg img2
.jpg title:'THE END' --audio-file-path /path/to/music.mp3 --font-path /path/to/my-fa
vorite-font.ttf
$ editly my-editly.json5 --out output.gif
linuxlala@playground:~/Downloads/projects/editly/examples$

Editly doesn't offer a man page, but the 'editly --help' command provides a quick introduction to the command options you can use.

Phone and tablet tips

Brilliant things to do on your device.

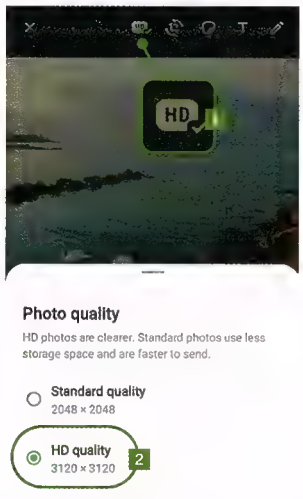
ANDROID & iOS

Send higher-quality photos and videos in WhatsApp

When you send a photo to someone in WhatsApp, the messaging app compresses the image to reduce its file size and conserve data. However, this also lowers the quality of the picture, which many users find annoying.

To address the problem, WhatsApp has introduced the option to send HD versions of photos at their original resolution. To use it, tap the attachment icon in the message box at the bottom of a chat and select either Camera to take a photo or Gallery to choose an existing picture.

Tap the new HD button in the top menu bar (1 in our screenshot below) and select 'HD quality' 2 under 'Photo quality'. Add a caption, and send the image as normal – an HD icon will be shown in its bottom-left corner within the chat. WhatsApp stresses that though HD photos are clearer, "standard photos use less storage space and are faster to send".



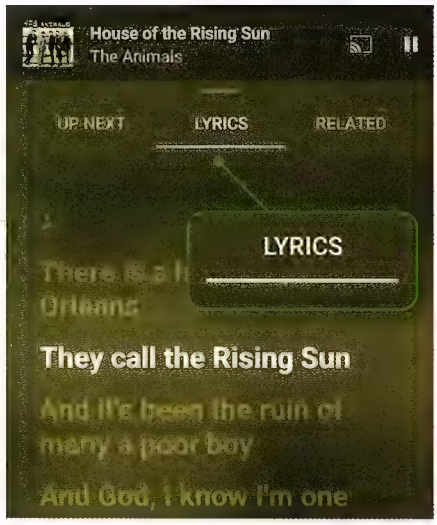
WhatsApp has also added the HD feature to videos, allowing you to send them at up to 720p resolution, rather than 480p.

ANDROID & iOS

Sing along with songs on YouTube Music

YouTube Music has updated the Lyrics feature in its app for Android (**tinyurl.com/APC526ytm**) and iOS (**tinyurl.com/APC526ytmio**), so you can sing along with tracks on the streaming service in real time. Previously, the app just showed a static set of lyrics, which wasn't ideal for impromptu karaoke sessions.

To try the new feature, start playing a song in YouTube Music and tap the Lyrics tab at the bottom of the screen. This will then move to the top (see screenshot above) and the lyrics will be displayed against a blurred background of the relevant album artwork.



YouTube Music uses a musical note to indicate audio before the music starts, then highlights the current line of the track in white, with the rest of the words shown in faded grey. Note that live lyrics aren't yet available for all songs on the service – some will either have a static version or none at all.

ANDROID & iOS

Add emergency information to your phone

Both Android and iOS now let you add emergency information to your phone so members of the emergency services know how to best treat you and who to contact when you're involved in an emergency.

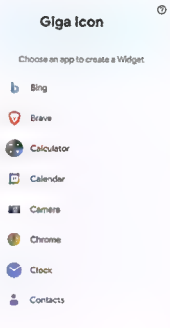
To add emergency information to your Android phone (version 12 or later), open the Settings app and tap 'Safety & emergency'. Select 'Emergency information' and tap 'Add information' (3 in our screenshot above right) under

Best new apps — What you should install this fortnight

OPERA BROWSER WITH AI

Free
iOS tinyurl.com/APC526opai

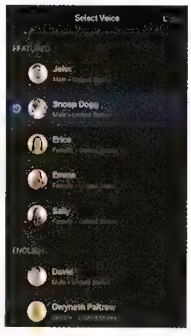
Opera's AI-powered browser, Aria, is now available for iOS, following the release of its Android and Windows versions. Tap 'Chat with Aria' to interact with the AI assistant by asking it to look up information online, generate content based on prompts and provide assistance with the browser. Aria requires a free Opera account.



GIGA ICON

Free
Android tinyurl.com/APC526gig

Giga Icon makes it easier to find and open apps on your home screen by creating large widgets for them. Simply choose an installed app in its list, select 'Add to Home screen' and move the resulting widget to the desired position. You can resize it by dragging its borders and tap it to launch the relevant app.

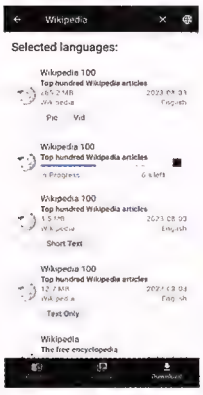


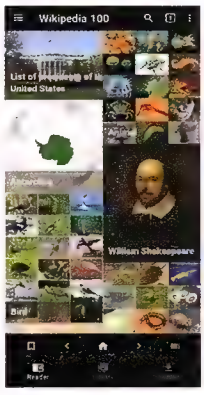
ARTIFACT: INTELLIGENT NEWS

Free
Android tinyurl.com/APC526ain
iOS tinyurl.com/APC526ainio

This personalised news app has added an AI-powered feature that lets you listen to articles read aloud in a natural-sounding voice. Tap the play button on the toolbar and choose a voice, accent and playback speed. Voice options include actor Gwyneth Paltrow and rapper Snoop Dogg.

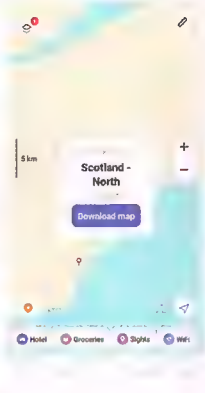
Best apps for... Accessing the web offline





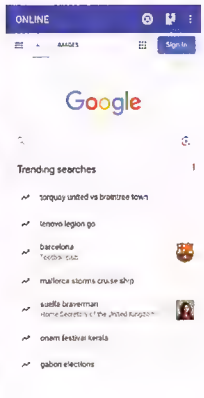
KIWIX

Free
Android tinyurl.com/APC526kiw
iOS tinyurl.com/APC526kiwio
Kiwix ensures you've always got something to read when you lose internet connection by letting you download the whole of Wikipedia to browse offline. Alternatively, you can save only the top 100 most popular articles, a 50,000-strong 'Best of' collection and curated selections for specific topics.
Best For: Reading Wikipedia offline



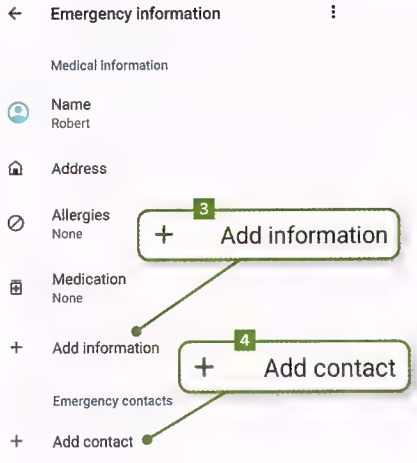
MAPS.ME

Free*
Android tinyurl.com/APC526mm
iOS tinyurl.com/APC526mmio
Google Maps lets you save maps to browse offline, but Maps.me makes the process much easier. You can download maps of specific regions or entire countries to explore without a connection. Simply tap the More button, choose Download Maps, search for the area you want to save and tap Download.
Best For: Exploring maps offline



OFFLINE BROWSER

Free*
Android tinyurl.com/APC526off
This app offers several ways to save web pages to browse offline. You can either add the links you want to download, tap the eye icon to search for pages using Google or copy links to the app from your usual browser. Downloads can be deferred until a convenient time and images excluded to save space and time.
Best For: Downloading web pages



'Medical information'. Here you can enter your name, address, blood type, allergies, any medication you're taking and whether you're an organ donor.

Next, tap 'Add contact' 4 under 'Emergency contacts' and select the person – or people – who first responders should call in an emergency. They're able to view this information when your phone is locked, and even dial your emergency contacts, by pressing the power button and selecting Emergency then Emergency Information. You can also use this method to add emergency details on older Android phones, which don't have the 'Safety & emergency' screen.

To add emergency information to your iPhone, open the Health app and tap Medical ID, then Edit. Enter your emergency contact details and enter information such as your date of birth, allergies, medical conditions and blood type. Turn on the 'Show When Locked' slider to make the information available on your Lock screen, then tap Done.

ANDROID
Follow content that interests you in Google News

Google has redesigned the Following feature in its Google News app for Android (**tinyurl.com/APC526gn**) to make it easier to find content that interests you. A new 'Follow your interests' section lets you choose topics such as Entertainment, Technology and Science to save them to a row of tiles along the top of your screen.

Tap one of these tiles to browse a feed of the latest relevant stories from various online sources, and switch between tabs representing sub-categories. You can view the full range of topics by tapping the 'See more topics' button, and search for additional topics by tapping 'Add interest'.

The old Following tab only allowed you to customise content that appeared in the 'For you' section of Google News, but the new version works more like an RSS feed. You can still tailor 'For you' by tapping the Library button and choosing your preferred sources of news and the locations you're most interested in.

iOS
Try a new Samsung phone on your iPhone

If you own an iPhone, you probably made a conscious decision not to buy an Android phone instead, but Samsung is hoping to change your mind with its Try Galaxy web app (**tinyurl.com/APC526ss**).

This turns your iPhone into a virtual Samsung Galaxy phone, allowing you to explore its apps and widgets as if you were using a real one. 'Try Galaxy' has been updated to showcase Samsung's new Galaxy Z Flip 5 and Z Fold 5 devices, and provides tutorials for their most notable features. Should you have two iPhones to hand, you can recreate the large, foldable screen of the Z Fold 5 by placing them side by side.

To try the web app, scan the QR code at **https://trygalaxy.com** to open the link in your iPhone's Safari browser. ■

Control a Pi bot with a Wiimote

Les Pounder travels back to 2014, the last time that he held a Wiimote that wasn't embedded in an LCD TV.

YOU'LL NEED
Pi 4/4B+/Zero W/2 W
Cytron Maker Drive
4x AA battery box
4x AA batteries
2x DC motors
5x female-to-male jumper wires
Code: tinyurl.com/APC526bot

Turn an old Nintendo Wiimote into a magic wand for your next robotics project.

We are travelling back in time. Nine years, to be precise. That was the last time we connected a Nintendo Wiimote to a Raspberry Pi. In this tutorial, we are learning how to configure a Pi to communicate with a Wiimote over Bluetooth. We'll put the connection to use by constructing a very simple robot control script to spin motors connected to a Cytron Maker Drive motor controller. Using this script as a template, you can easily build a remote-controlled robot using the Raspberry Pi 4, 3B+, Zero W or Zero 2 W.

Wiring up the circuit

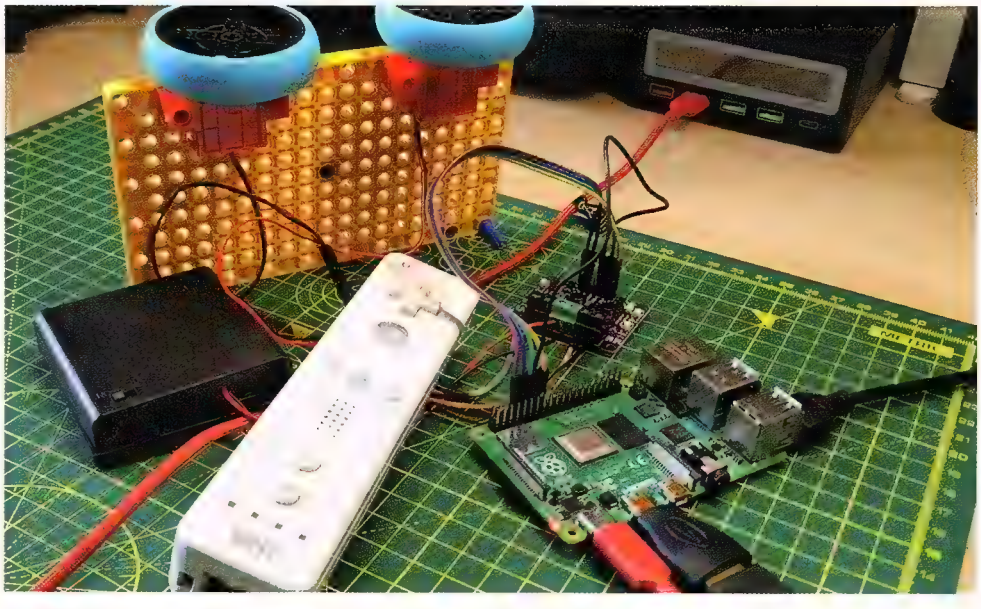
The circuit has four main components: a Raspberry Pi, a Maker Drive motor controller, motors and a power source for the motors. The Pi connects to the motor controller using pins 14, 15, 18 and 23. These control the direction in which the two motors spin. We also connect any GND pin on the Pi to the GND pin of the Maker Drive. Next we connect an external 5-6V power source to the VB+ (red) and VB- (black, GND) terminals of the Maker Drive. The VB- and Pi GND connection form a common ground from which the circuit can base a voltage reference. The motors are connected to M1A, M1B and M2A, M2B. These are controlled by the Pi GPIO pins, but the Maker Drive protects the delicate GPIO pins from the motors, as motors can pull a lot of current. Please refer to the circuit diagram in the project's download.

Setting up the Wiimote

Sadly, we can't just connect a Wiimote using Raspberry Pi OS's Bluetooth control panel. Instead we need to do a little work, but thankfully the wonderful Raspberry Pi community has created its own Python packages to make it really easy.

First, ensure your Pi is running the latest software. Open a terminal and run the following commands:

```
$ sudo apt update && sudo apt upgrade -y
```



In the terminal, install the following packages to ensure that we can install Cwiid:

```
$ sudo apt install wminput autoconf gawk bison flex libbluetooth-dev python3-dev git
```

Next, install the bluetooth package. This is different from the Bluetooth settings menu found in Raspberry Pi OS, which does not work with Wiimotes, sadly.

```
$ sudo apt install bluetooth
```

The final installation is Uinput, a tool that enables our Wiimote to emulate a user input device:

```
$ sudo apt install uinput
```

In the terminal, clone (download) this Cwiid GitHub repository. This is not the official repository, but it works well. There are multiple versions of Cwiid for Python 2 and 3, but this repository works.

```
$ git clone https://github.com/azzra/python3-wiimote.git
```

Change directory to the cloned repository:

```
$ cd python3-wiimote
```

Run the following commands to configure the repository ready for compilation:

```
$ aclocal
$ autoconf
$ ./configure
```

Now compile Cwiid and install it to your system.

```
$ make
$ sudo make install
```

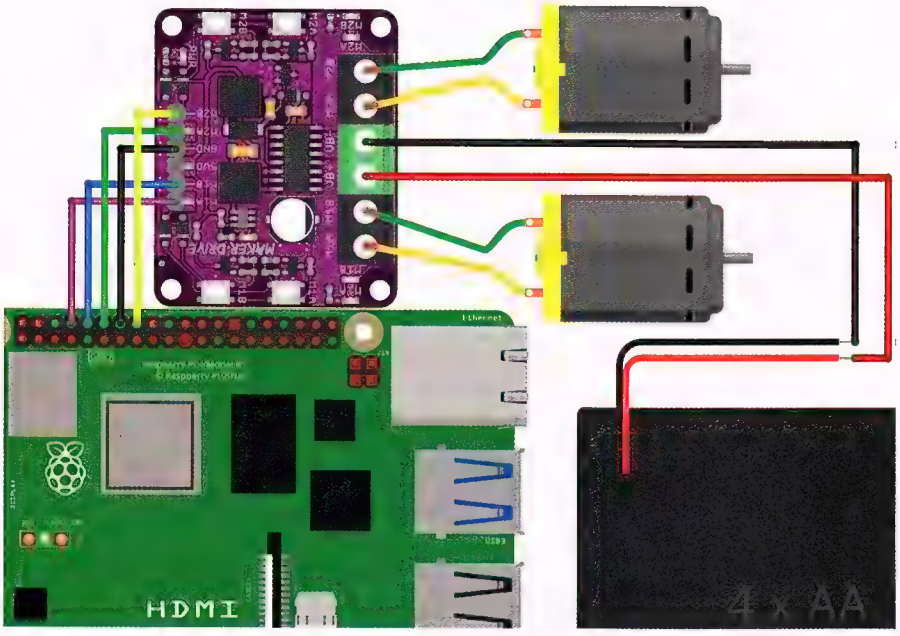
Right now, only root can access the Wiimote – we need to make a new udev rule for Wiimotes. In the terminal, run this command to create a new udev file:

```
$ sudo nano /etc/udev/rules.d/wiimote.rules
```

Add this line and then press Ctrl+ X, Y and Enter to save and exit:

```
KERNEL=="uinput", MODE="0666"
```

Restart the udev service to reload the rules, including the new Wiimote rule:



The circuit for this project is split into four areas: the Raspberry Pi, the motor controller, motors and power. Check that there is a common ground.

> "In this tutorial, we are learning how to configure a Pi to communicate with a Wiimote over Bluetooth."

```
$ sudo service udev restart
```

The final installation step is to load the Uinput module on boot, so open a terminal and run the following command:

```
$ sudo nano /etc/modules
```

Go to the bottom of the file and add the following line. Then press Ctrl+X, Y and Enter to save and exit.

```
uinput
```

Reboot the Raspberry Pi and return to the desktop.

Using a Wiimote with Python

With Cwiid, we can write code to interact with the Wiimote and use it to trigger events. Select Thonny from the Programming menu. A new, blank document opens. Our first three lines of Python are imports for cwiid, time and the Robot class from GPIOZero.

```
import cwiid
from time import sleep
from gpiozero import Robot
```

GPIOZero's Robot class creates two motors (left and right) for which we pass the GPIO pin references. The left motor is on GPIO14 and 15; the right one is on 18 and 23. Note that we've written it 23,18, so that the motor spins in the opposite direction to the left. This means that when the robot chassis is built, the robot will move forwards and backwards.

```
robot = Robot(left=(14,15), right=(23,18))
```

Print an instruction to the user to press 1 + 2 on the Wiimote to enter pairing mode. A three-second delay means they have time to react.

```
print("Press 1 + 2 to set the wiimote into pairing mode")
sleep(3)
```

Next, create an exception handler that will try to connect to the Wiimote. If it fails, typically a NameError then a runtimeError is raised and we can exit gracefully.

```
try:
  wii=cwiid.Wiimote()
  wii.rpt_mode = cwiid.RPT_BTN
except NameError and RuntimeError:
  print("I couldn't see a Wiimote")
  exit()
```

If the Wiimote is connected, then the while True portion of the code is activated. It creates an object, buttons, which stores the current state of all the Wiimote's buttons.

```
while True:
  buttons = wii.state['buttons']
```

Now we look for a specific button press in buttons. We are checking that the Up direction has been pressed. If so, we want the robot to move forwards:

```
  if buttons & cwiid.BTN_UP:
    robot.forward()
```

What if we want to go backwards? A press of the Down direction spins the motors in reverse:

```
  elif buttons & cwiid.BTN_DOWN:
    robot.backward()
```

The all-important Stop button is A, just under the directional pad. Pressing this hard-stops the motors.

```
  elif buttons & cwiid.BTN_A:
    robot.stop()
```

The last two lines are outside of a conditional test and merely print the current button press (as a numerical value – more on that in the boxout below), then pause for 0.1 seconds.

```
  print(buttons)
  sleep(0.1)
```

Save the code as wiimote-control.py. Click Run to start the code. On the Wiimote, press 1 + 2 to enter pairing mode. Once connected, you will see numbers scroll up the screen; this is the numerical value of the currently pushed button, 0 meaning no button. Press Up or Down to spin the motors and press A to stop.

You've just built the basis of a Wiimote-controlled robot. We could replace the Pi 4 with a Zero W, Zero 2 W or Pi 3B+ and get the same performance. ■

INPUT... INPUT.... INPUT!!!

Each button on the Wiimote returns a numerical value. In the tutorial, we ignored that and just searched for a specific button press. But what if you want to detect a specific combination of buttons? Well, Cwiid has us covered, but we need to do some maths. The up direction returns a value of 2,048, down is 1,024, and A is 8. So, if we press down and A together, it returns 1,032. The tutorial script returns the value of each button press, so all you need to do is a little maths for your chosen key combination. We can then use an additional conditional test to look for a specific numerical value in the buttons object. The value, once detected, could trigger an event, drift the robot around a track or world domination, your choice.

We've provided an additional file, wiimote-control-numerical.py, which has an example of how to handle numerical input. The only buttons we don't advise pressing are the power button and the - and + buttons. These cause the code to hard exit, but it doesn't tell you that it has exited. The file is included in the download for this tutorial.

DOWNTIME

The games we play

PRICE $119.95 **PLATFORM** PC, XBS/X **WEB** bethesda.net/en/game/starfield

Starfield

It may be Bethesda's biggest RPG, but it's far from its best.

The more I've played *Starfield*, the more I've liked it, and for the same reasons I enjoy Bethesda's other RPG sandboxes. It's got the fun collision between structured quests and unpredictable systems which create moments that feel more personal and memorable than many other games.

It took me a while to get there. *Starfield*'s introduction is unusually straightforward for a Bethesda RPG, and the first handful of places you visit, including the game's capital city of New Atlantis, are pretty dull. It took about a dozen hours before I started having real fun, and after rolling credits on the main quest with one character and ignoring that quest to become an aspiring drug kingpin with another, I can finally say that, in the end, I do like *Starfield*.

But I don't love *Starfield*. And that's genuinely disappointing because I've loved each of Bethesda's RPGs since 2006's *Oblivion*. *Starfield* is Bethesda's biggest RPG ever, and it shares even more DNA with *Skyrim* and *Fallout 4* than I expected – but it ultimately falls short of the greatness of both of those games.

Slow liftoff

Bethesda RPGs have a history of awesome opening sequences: the assassination plot and escape through the sewers in *Oblivion*, living through your entire childhood in *Fallout 3*, and of course the iconic wagon trip to your execution in *Skyrim*. So it's almost startling how straightforward *Starfield*'s opener is.

It's the year 2330 and humankind has colonised the galaxy, and you're a miner on a distant planet who finds a mysterious artefact during your first day on the job. Then things happen quickly: you shoot some pirates, learn to fly a spaceship, and meet a few explorers who are part of a group called Constellation, looking to find more artefacts like yours. I kept waiting for some 'wow' moment that would make the tutorial feel less like a tutorial, but the only surprising thing about my introduction to *Starfield* was that it didn't contain any surprises.

> "I don't love Starfield. And that's genuinely disappointing because I've loved each of Bethesda's RPGs since 2006's Oblivion."

ABOVE Boarding enemy ships for a long, close-quarters battle is the best.

Thankfully, once I'd left the early hours behind I finally began to see flashes of Bethesda brilliance. First it was via the traits I'd chosen during character creation: one trait gave me parents, a retired, middle-aged mum and dad, with the downside that I had to support them with a weekly cash allowance. At first my folks were simply sweet and supportive – impressed with my new job at Constellation, telling me they'd heard about some of my exploits on the news – but later they began popping up unexpectedly and hilariously in places you wouldn't expect to see your ageing parents. My space-folks eventually became one of my favourite parts of *Starfield* as they had their own little adventure in the background of my grander one,

1 Some alien critters are mean, and some are nice, or at least neutral.
2 New Atlantis is just a little too generic to impress me.
3 Hundreds of worlds await, though don't expect them all to be interesting.
4 Meet the team dedicated to solving space mysteries from their swanky pad.
5 Zero-G combat is loads of fun, but strangely there isn't all that much of it.

and their cameos around the galaxy were never pinpointed with a quest marker, particularly refreshing for a Bethesda game. Even just that single trait (and you can pick up to three in character creation) added more to my character's experience than any of *Cyberpunk 2077*'s disappointing 'lifepaths' did.

Faction action

I quickly signed up to be a space ranger in the Freestar Collective – they're still basically cops like the United Colonies, but at least they dress with panache. And that kicked off a series of faction quests beginning with a classic Western premise: a humble farmer being run off their land by hired thugs. It was a long and enjoyable series of connected quests leading through some cool sci-fi environments like a huge mech graveyard and a mining operation inside a crystal-filled asteroid. There were plenty of shootouts, a couple of fugitive hunts and a big bad guy who needed to be toppled, just like in any good Western. It also introduced some interesting lore to *Starfield*'s universe as anger and bitterness over a war long past came bubbling to the surface.

At least the story of the main quest is a creative one. When I first learned *Starfield* was about finding mysterious ancient artefacts buried deep inside planets, I figured I knew how it would end up, and I'm happy to say I was completely wrong (and even happier to say that pretty much everyone posting story theories on Reddit is also completely wrong). The story of *Starfield*'s main quest genuinely surprised me on more than one occasion (to be precise: two occasions), and being surprised is never a bad thing. The conclusion of the main quest also gives rise, quite brilliantly, to *Starfield*'s New Game+, allowing you to retain your character and skills while starting over from the beginning in a way that makes perfect sense within the game's story.

Too big to fill

Sapping a bit of my enthusiasm for being a helpful star-hopping cowboy was the star-hopping itself. I never expected *Starfield* to be the sort of fully open-ended spaceship sim *Elite Dangerous* is, or for it to replicate the freedom of flight in *No Man's Sky*, but it's hard not to feel like there's something missing here: I never felt excitement or awe, no goosebumps as my engines fired, no sense of grandeur as I set down on a new world. That's because despite cruising from one end of the galaxy to the other in *Starfield*, I never felt like I was really going anywhere.

After all the hype and hope and anticipation, I'm disappointed to say I don't love *Starfield* the way I love other Bethesda RPGs. It's similar in a lot of ways, but *Starfield* never feels as instantly engrossing and transporting as *Oblivion* or *Skyrim* or as wild and weird as the *Fallout* games. It comes close on occasion: one settlement on a far-flung planet is right up there with the most entertaining Vault-Tec experiments of all time. But more often the promising premises I found in remote bases or mysterious space stations tended to fizzle out. *Starfield*'s alien bugs, even the truly monstrous ones, don't hold a candle to *Skyrim*'s menagerie of beasts, and though *Starfield*'s spacers and *Fallout*'s raiders probably share the same basic code (rush and attack player on sight) they just don't have as much personality.

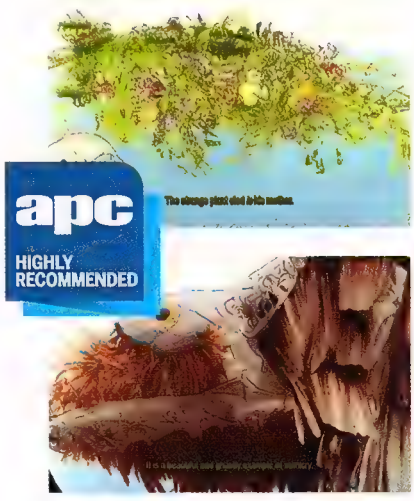
So, I don't love *Starfield*, but I was happy to discover that I do like it. Those first 90 hours I played were far from perfect, but I've got plenty of reasons to play 90 more.

VERDICT

★★★½

Starfield shares plenty of DNA with *Skyrim* and *Fallout 4*, but it ultimately falls short of both.

Christopher Livingston



PRICE Free **PLATFORM** PC, Mac, Linux
WEB bit.ly/ScrimshawP1

SOUTH SCRIMSHAW, PART ONE

A FASCINATING SCI-FI DOCU-GAME.

South Scrimshaw, Part One has really come out of nowhere, using a familiar framework to show something thrillingly new. It's sort of a visual novel – but forget the cutout characters and dialogue choices. No, we're being told the story of the Brillo whale – enormous whales that adorn their bodies with other sea life, in a symbiotic process – and our only choices are whether to hear more of it, when given the option.

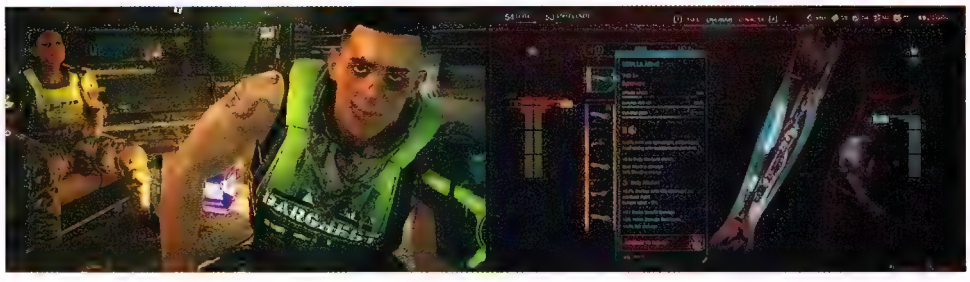
The artwork is extraordinary. From the scientific cross-sections of important species to the zoomed-out portraits of the hulking whales, there's a real sense of majesty and authenticity to this aquatic society. It's all static images, but there are an enormous quantity, and I'm not sure they are ever reused.

As you advance the story paragraph by paragraph, occasionally a hyperlink will appear in the text, sending you down a rabbit hole of supplementary lore. It's all as well-written and interesting as the main text, so you'd be mad not to click on every link if you're enjoying yourself.

VERDICT

★★★★

Scrimshaw captures the awe of the best nature documentaries, while teasing an intriguing sci-fi setting on the periphery.
Tom Sykes



PRICE $44.95 **PLATFORM** PC, XBS/X, PS5 **WEB** www.cyberpunk.net/us/en/phantom-liberty

Cyberpunk 2077: Phantom Liberty

A tense spy thriller with strong narrative.

Phantom Liberty is an extra-refined bite of *Cyberpunk 2077* – an expansion pack's expansion pack. It doesn't reinvent the game as a whole, but it's a fantastic final outing for V and Night City, as well as one of the best individual stories CD Projekt Red has told to date.

After a legendarily fraught launch and three years of rebuilding, *Cyberpunk 2077* is finally the RPG its world and characters deserved, and *Phantom Liberty* is a fine last hurrah for a game that's taken CD Projekt so long to hone. It took me a second to come around to *Phantom Liberty*'s setup: rescue the president of the New United States after Space Force One (LOL) gets shot down over Dogtown, a newly added district of Night City that looks like the Thunderdome by way of *Blade Runner: 2049*'s haunting, irradiated Las Vegas.

CD Projekt is great at teeing up a story that seems like it'd be derivative or Spike TV-edgy, then absolutely curving you with unexpected depth and nuance, and that's no different here. President Myers comes off as a down to earth, one-of-the-guys former soldier, like Harrison Ford from Air Force One, but there's a serpent-like ambition to her that comes out as the story goes on.

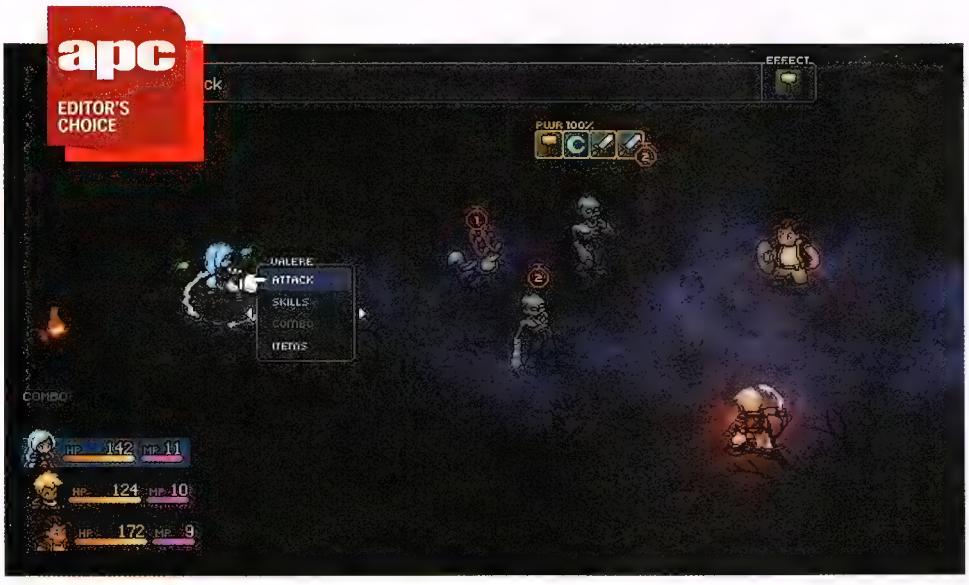
I always enjoyed *Cyberpunk*'s smaller sidequests, or gigs, too. Many are simple but enjoyable 'go here and kill everyone as fits your playstyle' deals, but some of them felt more like full-on side stories with voice acting, a twist, and maybe even a gameplay curveball. *Phantom Liberty*'s gig additions firmly fall into the latter camp, and I loved each one.

I'm extremely pleased with *Phantom Liberty* – CD Projekt can hang with the big dogs when it comes to cinematic storytelling. I've been eager to see what CD Projekt would do with a *Cyberpunk 2077* expansion ever since first beating the game at the end of 2020, and *Phantom Liberty* is a splendid sendoff for the world CD Projekt's been working on for the better part of the last ten years.

VERDICT

★★★★

Phantom Liberty doesn't reinvent *Cyberpunk 2077*, but it is CD Projekt firing on all cylinders to tell a great RPG story.
Ted Litchfield



PRICE $50.95 **PLATFORM** PC, PS4/5, XB1/S/X, Switch **WEB** seaofstarsgame.co

Sea of Stars

Blows a fresh breeze through an old genre.

Sea of Stars is another indie RPG built in *Chrono Trigger*'s image. There's the seamless battle transition, there's the techs, sorry – combos, there's the Yasunori Mitsuda soundtrack. Been there, done that, got the time-travelling T-shirt. What separates *Sea of Stars* from the ever-increasing pile of RPGs that think they can recapture the spirit of the '90s is that it understands the difference between 'inspired by' and 'mindlessly copying something'".

The most obvious way it draws a line between itself and the past is through its extremely – almost excessively – well-animated world. Anything that can sway in an unseen breeze does so, and every every mundane NPC or minor story event I came across seemed to have some unique flourish I saw once and then never again. The main cast have been lavished with even more attention, allowing them to move around their gorgeous surroundings with the sort of fluidity their 1995 ancestors could only dream of.

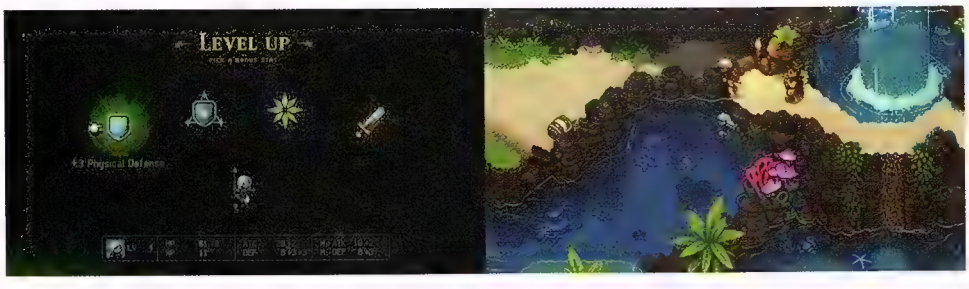
Unbreakable genre rules dictate that our heroes' athletic exploration must be broken up by fights with monsters vaguely themed around the local area, although *Sea of Stars* livens up these fixed encounters with a brilliant turn taking/breaking mechanic, making it possible to severely weaken or even completely interrupt potentially devastating special attacks before they're set off – so long as I can unleash the correct combination of attribute-laden slashes and skills before their next turn comes around.

As thoughtfully retro-modern as much of it is, the story can't quite escape the less impressive parts of RPG history. The NPCs may look pretty, but by and large only have the same shallow one-line scraps of nondescript text their genre ancestors said 30 years ago. Whatever problem the latest village has can often only be solved with a quick trip through the dungeon-like area nearby. In spite of these grumbles, there's a sincerity to the game that just about manages to hold it all together. The poisonous metahumour that tends to rear its head in retro-styled indie games is in here, but these instances tend to be somewhat rare.

VERDICT

★★★★½

Sea of Stars offers a polished and enjoyable blend of the old and new.
Kerry Brunskill



PRICE Free **PLATFORM** Browser
WEB dukope.itch.io/lcd-please

LCD, PLEASE

BACK BEHIND THE DESK.

To celebrate the tenth anniversary of *Papers, Please*, developers Lucas and Keiko Pope have created a demake/spin-off that lets you control the border of glorious Arstotzka from a simple LCD screen.

I'm lucky enough to have owned some LCD games, and the accuracy of LCD, Please is uncanny. It's there in the bassy, bleepy sound effects, in the subtle screen glare and light screen scratches, and it understands how sprites were drawn on LCD devices.

Gone are many of your tools for finding discrepancies in the documents you're handed at border control – but the spirit of *Papers, Please* is present and correct. Your job is stripped down to pressing Approve or Deny, as a procession of faces appears on the screen. Does their name and face match those on their passport, are they a wanted person, do they come from a banned country? That's really all you're looking for, and you compare the data by pressing the View button at the top of the device. There's just enough of the original here to still be engaging.

VERDICT

★★★★

There's just enough of the original here to still be engaging.
Tom Sykes

RELEASE November 11, 2015 **DEVELOPER** Bethesda Game Studios **PUBLISHER** Bethesda Softworks **LINK** beth.games/3YMV180

Fallout 4

Tyler Colp revisits Bethesda's strangest opening sequence.

A staggering eight years ago, *Fallout 4* was released. Its developer, Bethesda, made the swap back to the rusty post-apocalypse after having launched what would become one of the most influential open world RPGs of all time, *Skyrim*, just three years before. In many ways, *Fallout 4* is a sequel to both *Skyrim* and *Fallout 3*. It refines the expansive structure of the fantasy setting by rooting it in the familiar, real world locations of the ruined American setting. It begins before the bombs fall, in an intro sequence that whiffs an attempt to ground your character in its fascinating world.

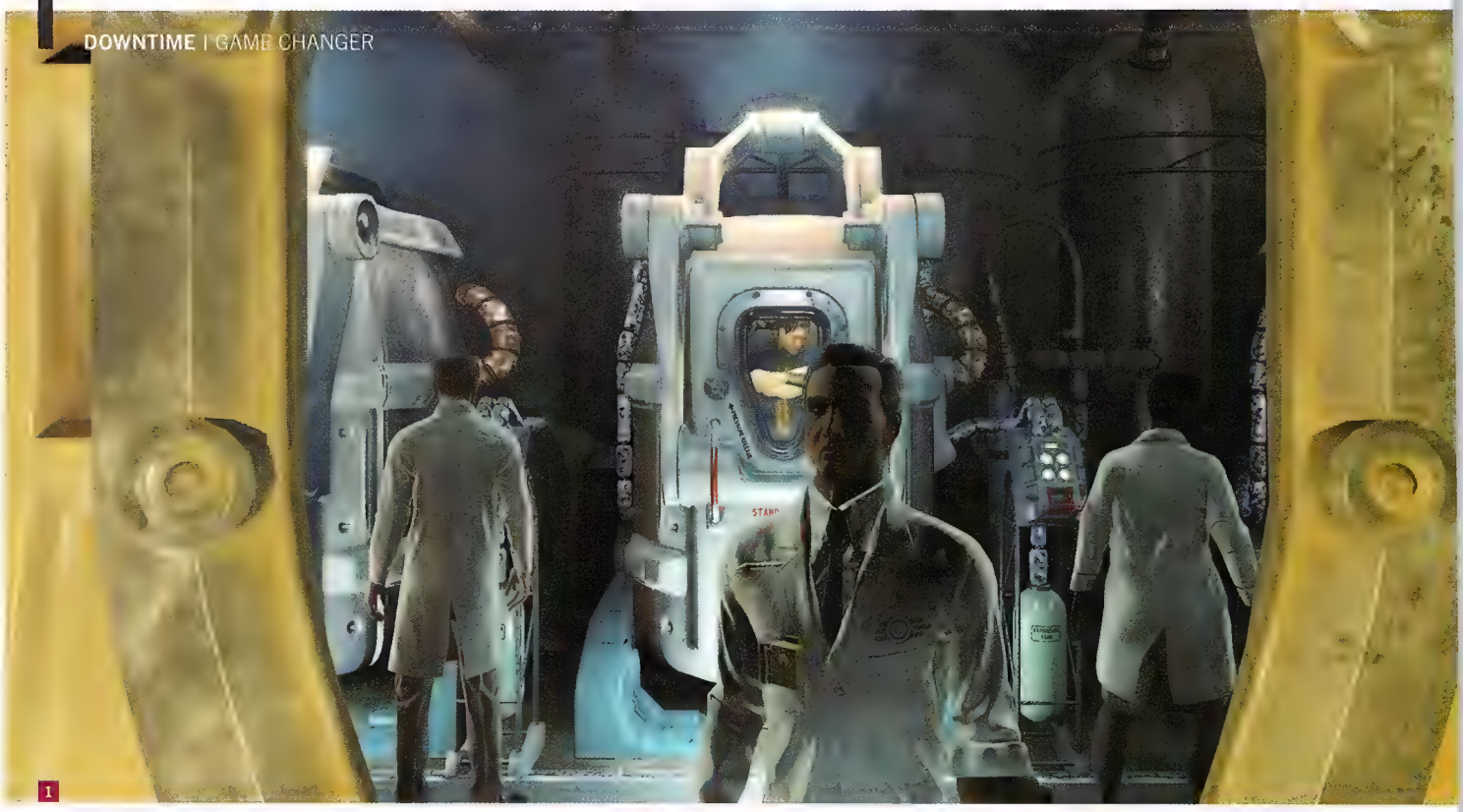
You're already awake and staring at the bathroom mirror in the first ten minutes of Fallout 4. This comes immediately after a narrated autobiography of Nate, *Fallout 4*'s male protagonist and the husband of Nora, the female protagonist. You can sculpt their faces into whatever shape you'd like and then step out of the bathroom into a house so idyllic it would be invisible in *Fallout 3*'s parody of 1950s suburban life in its Tranquility Lane mission.

Time freezes as you preemptively train your scavenger brain by searching each room for objects to interact with. Cereal boxes, Nuka Cola, and your own infant son are prompts for your character to reflect on the mundanity of living comfortably and ignorantly in a country whose leaders were secretly preparing for nuclear catastrophe.

Quiet intro

Fallout 4's quiet intro plays everything rather straight for the fourth entry in a series about the hubris of America. It's playful in a way videogame tutorials often are – go this way, touch that, follow me. You need to become a parent in the next 20 minutes and that means you're going to have to look at a baby a few times. Look at Shaun, all bundled up in his crib. Tap the mobile to stop him from crying and don't perceive the irony of being trapped in a house full of playthings to keep you, the player, from crying. If you finished *Fallout 4*, you know why all of this is here and why this fails as a reasonable origin story for the super soldier you eventually become.

To Nora, it's a normal sunny day in a Xeroxed house in a Xeroxed neighbourhood. She's a lawyer and he's a war veteran, and they both are conveniently situated in the safest bubble of America.



Fallout 4 celebrates the nuclear family so that when it's obliterated, it can argue that something was lost. But *Fallout 4* goes so far as to include a lesbian couple as your neighbours and a handful of Black families, too, the sort of people who might've already lost a lot more than you.

When I passed by them as I replayed *Fallout 4*'s intro, they were frightened more than I was. My family had just been told that, because of Nate's service to the country, we would have a place in the local Vault-Tec Vault should the war against China spread into our borders. Other than the panic of armed police hurriedly ushering us toward the vault, my family fit perfectly into the part of America worth preserving. The first few minutes of *Fallout 4* hit much differently when you live in a global pandemic where governmental hospitality and policies prioritise a certain type of citizen over others.

Instead, *Fallout 4*'s imagination is surprisingly small for a starting experience set in the nostalgic era the series has lambasted for decades. It's entirely possible that Bethesda meant for you to read all of this as a caricature of 1950s American life. It is that, but I'm not sure it makes a clear argument that you shouldn't enjoy it and mourn it when it's suddenly buried in atomic clouds. The only bit of skepticism comes from a

1 Being cryogenically frozen is a horrifying experience.
2 This board game's title isn't on the nose at all.
3 Take a break from this traumatic event and try to get a high score.

dialogue choice in a conversation with the Vault-Tec employee who warns you of a possible apocalypse. You can make a joke about the likelihood of the end of the world two minutes before it happens.

Let me out

After the bombs go off as you take the elevator deep underground into the vault, the real *Fallout* begins. The familiar titanium walls and uniformed Vault-Tec employees welcome you to a future you know won't last. Other fortunate families panic as the guards push you down the line toward the cryo tanks where you'll spend the next 200-ish years.

Your entrance into Vault 111 emulates the unease of going through airport security. You stumble along trying to avoid trouble while too scared to ask why any of this is necessary. The specificity of this anxiety in a scenario where your character's life affords zero benefits, is the sharpest part of *Fallout 4*'s opening hour. It's frightening to be treated like a number and worse when you're given the blue and yellow jumpsuit to fully become one.

Plot happens and you're left husband-less and baby-less in an empty vault. Mostly empty – the Radroaches took over when the people revolted. Discarded skeletons lay on the metal floors as you run past and the place you were told would be safe is now an obstacle on your path to avenge your spouse – an instantaneous decision only a videogame protagonist could make. You find a pistol and use it to dispatch the roaches with one of *Fallout 4*'s most controversial changes from the previous game: a higher level of baseline firearm proficiency no matter what kind of character you choose to be. For a lawyer, Nora sure can aim, and it jerks you right out of what could have been a frantic, desperate escape (something that makes more sense if you choose to play as Nate). The horror of reading logs about the people who were trapped here for months wondering if the government would ever let them out, or if there is anything left to be let out to, fades when you've got a gun in your hands.

There's no avoiding that this is an FPS where the shooting should be satisfying, but for all the effort to lock you in a maze with cheese at the end, *Fallout 4*'s ambitions crumble a little early. So much work goes into establishing your character as wilfully ignorant of the war outside their door and instead of reacting to the death of their loved one with horror, they transform into Rambo.

This is where Bethesda seems to struggle the most. Its worlds are stuffed with stunning landmarks, eccentric characters and satisfying carnage, but the emotional journey of its characters, especially that of the protagonist's, are on 2x speed. I'd be willing to cut it some slack given the inherent absurdity of the setting if the writing or systems slowed down a bit and gave you time to respond to what is a pretty fascinating premise.

"Its worlds are stuffed with stunning landmarks, eccentric characters and satisfying carnage, but the emotional journey of its characters, especially that of the protagonist's, are on 2x speed."

Detailed worlds

I like a fair amount of the rest of *Fallout 4*, and am aware that many Bethesda game intros fail to capture the actual draw of the experience. But millions of people just played *Elden Ring*, an RPG that also opens in a sealed-off area that acts more as a thesis underlining the mood of the world rather than offering a bunch of convoluted reasons why you should actually care about it.

With *Starfield* now out, and suffering from another flat, compromised intro, I'd love to see Bethesda transfer some of the mastery it has with building massive, detailed worlds into an intro for its next game that confidently anchors me to its fiction. An intro that pulls in everything it's learned from its past games and modern culture. However, even if *Fallout 4*'s intro falls flat, the ambition behind it is more than enough to create an opener that I won't forget. ■

Vault check

UNSEALING APC'S THOUGHTS ON *FALLOUT 4*

"Bethesda's *Fallout* games are primarily about the atmosphere of the world at large, and *Fallout 4* is no different.
Phil Savage

"Bethesda RPGs have always given players ample room to ignore the official narrative and create their own characters, histories, motivations, and stories, and *Fallout 4* is no exception.
Chris Livingston

"[*Fallout 4* is] full of a new story, new characters, and plenty of other things to keep you busy, but if you were hoping for a graphical upgrade … Bethesda apparently isn't interested in such things.
Jarred Walton

"It's more like an FPS than an RPG: a series of rooms linked with corridors, filled with enemies waiting patiently for you to kill them.
Andy Kelly

SCORE ★★★★★ **PRICE** Around $250 (if you can find one)

The 38-year review: Amstrad CPC 6128

Fired or hired? David Crookes explains that Lord Sugar's Amstrad CPC 6128 is still a sweet buy.

Night after night for a few weeks in the late 1980s, I would gaze longingly at a photograph in a copy of *Smash Hits* magazine. To see this object of my desire, I needed to flick past numerous images of Debbie Gibson, Madonna and Kylie, but there was so much to take in and admire.

For starters, there was a sleek-looking computer with a built-in 3in disk drive, a sturdy-looking joystick and a collection of 17 games with familiar names such as Monopoly and Trivial Pursuit. There was a colour TV monitor and a clock/radio, all sitting upon a smart desk. Lying in a bed in a room bereft of entertainment, it felt like the stuff of dreams.

At the time, I knew very little about computers. I'd played a couple of games of *Chuckie Egg* on a BBC Micro at school and my attempts at typing had been typically laborious. It meant I didn't know that 3in disks were an expensive anomaly nor that bundled joysticks tended not to last more than a couple of sessions of *Daley Thompson's Supertest*.

I didn't even know what was under the hood of this machine – the advert merely stated that it had the memory of a whole star system! All I remember is being absolutely thrilled that my parents went on to generously buy me this amazing-looking computer for Christmas. And I've been in love with the Amstrad CPC 6128 ever since.

Pale not stale

Today, that exact same computer still sits on my desk and it has been a constant presence in my life. It has seen me through school, college, university and even work. I regularly power it up, buy games and hardware, and visit forums such as **CPCwiki.eu** for the latest news and chatter.

ABOVE The CPC instantly detects when ROMs are plugged in.

In many ways, that's going to make this review a tad biased at times but, as you'll see, Amstrad's early computer was packed with potential. Although the designers made some frustrating decisions (opting for a 3in drive over a 3.5in version being the primary one), it was clear a lot of thought had gone into its creation, allowing for a lifespan years beyond Amstrad's expectations.

When the CPC 6128 was launched in 1985, the computer was riding on the back of the success of the CPC 464, Amstrad's debut machine, which had 64K of memory, a Zilog Z80A CPU and a compact built-in tape deck. Amstrad had also launched a disk-based computer called the 664 that used the same processor and memory, but that had only been on sale for six months.

BELOW From the old to the new, there are plenty of games to enjoy.

The 6128 was, in essence, a re-cased, better-looking 664 with 128K of memory, created in response to a growing demand from retailers for a computer with a greater capacity than machines such as the Commodore 64. It debuted in America (and flopped) but grabbed attention in Australia, the UK, France, Spain and Germany. Crucially, it also turned heads among serious computer users, attracted by the comfortable, full-sized keyboard and ability to run the CP/M+ operating system. Amstrad wanted its computer to appeal to all.

Look at the CPC 6128 today and you can still see the attraction. This is a machine that wouldn't look entirely out of a

place in a contemporary office. The keyboard is particularly alluring. Unlike the 464, which separated the cursor keys and numeric pad from the main Qwerty layout, the 6128 bunched the keys far more closely. Amstrad also dropped the scattering of red and green keys that made the 464 look almost toy-like. Instead, the 6128's pure grey keys gave the computer a more professional appearance.

But what's it like to use? Touch those satisfyingly springy concave keys and you'll feel the distinct upwards curve towards the left and right edges, allowing even the most sausage-like of fingers to slip effortlessly into the dip and back out again.

As a modern user, you'll have no trouble finding your way around. There are no C64-esque symbols printed on the side of the keys here, nor lots of additional functions as on the ZX Spectrum. Yet the sensation of hitting the edges of those keys as you glide your fingertips across them could annoy some users and, since the keyboard is also elevated by 3cm to accommodate the computer that sits beneath, typing on the 6128 will take some getting used to.

That said, it is perfectly possible to tap away for hours without tiring – something I've done many times over. One of the biggest concerns is whether or not your eyes can take the strain.

When I first began using my CPC 6128, I had no problems staring at the bundled Amstrad CTM644 colour monitor (there was a GT65 green screen alternative). But, as time has gone on, it has felt less comfortable and less enjoyable – more so when switching focus from a crisp Apple Retina display.

Luckily, you aren't restricted to using the official CRT monitor, even though it packs the power supply needed to run the CPC 6128. Some have tried using a different CRT display by picking up an Amstrad MP2 modulator, but that's unlikely to solve the problem. I suggest you visit a reputable retailer and pick up a TV connection kit for less than $60. This lets you connect the computer to a television with a Scart socket, and you'll also get a power supply to provide juice to the main unit and disk drive.

For anyone buying a CPC 6128 online without a monitor this is a great solution, but there's also a way to connect the machine via HDMI so long as you're willing to invest in a HDMI converter box. In either case, the upshot will be a crisper, more readable display and more room on your desk as well. So what fun actually awaits?

The basic stuff

When you turn on the CPC 6128, you're greeted with a command line interface and, in general, you have two options: load software or start to code. If you fancy doing the latter you can get straight down to work, but it would help enormously if you had the brilliant official instruction manual to hand (a tome you can view by going to **tinyurl.com/APC526manual** if you don't have a printed copy).

Unlike many modern manuals, it's very comprehensive. As well as giving you the lowdown on how to use the CPC 6128, it attempts to teach you the fundamentals of BASIC programming while delving deep into the workings of the machine with great clarity. As you

ABOVE The advert that captured my imagination!

read, you can feel the passion of the writers shining through – writers such as Roland Perry, a computer engineer who had a leading hand in designing the CPC.

Perry told me that the manual was always considered to be an important part of the CPC 6128 package. "I was interested in the CPC as an affordable replacement for the BBC Micro and I wanted youngsters to learn about computers too," he said. "Much of that could be done by writing better BASIC and having an instruction book which explains things properly. Neither of those costs a cent extra to manufacture."

The CPC's BASIC language was among the very best of the era. Developed by Locomotive Software and influenced by BBC BASIC, it had a host of graphic and sound commands and a simple memory management interface. It's possible to create complex programs and perform tasks that, on other machines, would require assembly language. It's still worth learning.

To assist, the manual gives an introduction to the language's keywords, easing you in gently with the usual stuff such as print "hello". It then shares lots of examples, shows how programs can be edited, explains how colours and graphics work and demonstrates how you can create sound. There's also a list of keywords with explanations for each one, making the manual an excellent teaching and reference guide. Find a copy that isn't well thumbed and you'll find an owner who didn't really get to grips with their CPC.

Game on

Of course, you won't just tap away producing your own programs. As with any computer you'll acquire, whether contemporaneously or years after its release, you'll inevitably want to see the fruits of other people's labour. In that sense, you're very much in luck.

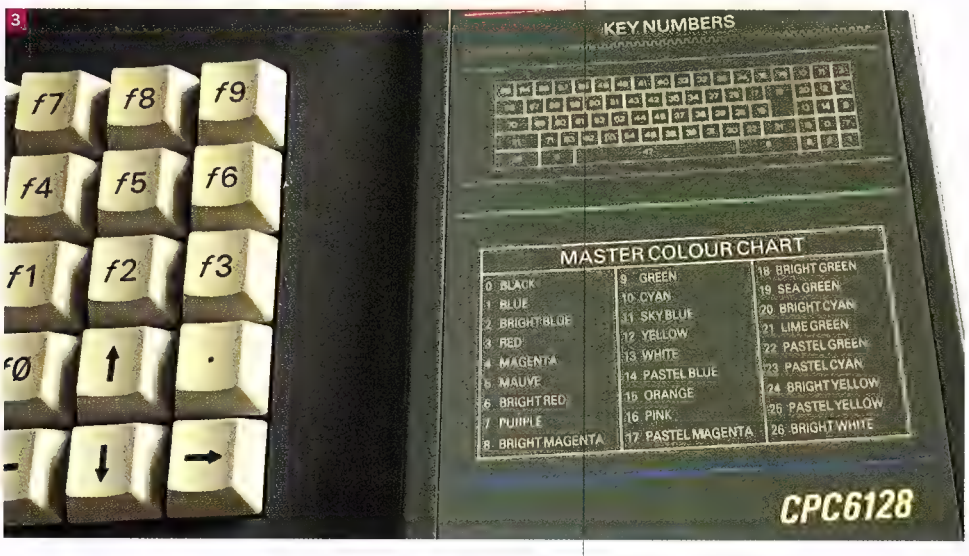
The 6128 was, and is, very well supported. To start with, there's a whole range of programs available to run via CP/M+ (a copy of which is essential if only because it lets you format and copy disks). A lot of software has also been created specifically for the computer.

Some of those titles – games, educational software and utilities – were published under Amstrad's own label, Amsoft, but third-party publishers also flocked to the machine, leaving reviewers working for the platform's leading magazines, *Amstrad Action* and *Amstrad Computer User*, very busy indeed.

The upshot is that you're unlikely to be bored when fiddling around with the computer today. Even if you only intend to play games, then you'll certainly be well served. The CPC's vast catalogue of games is arguably the main reason why people are still using a 6128, and they can help to showcase just what the computer can achieve.

Although many titles were straight ports of games created for the ZX Spectrum – titles that generally didn't go down well among CPC owners – those that were created from scratch had the potential to stand out. It's worth checking out the fantastic arcade conversion of *Chase HQ* complete with digitised speech and the stunning exclusive that was the *Pang* clone *Zap't'Balls*.

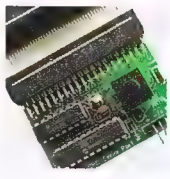
French developers had a knack for getting the best out of the computer with the likes of *B.A.T.* and *Crafton & Xunk*. And many more jaw-dropping titles, including *Gryzor*, *Nigel Mansell's World Championship*,



1 You can still buy ROM boards such as the Rombo Redux Deluxe. 2 The CPC had a nicely laid out, professional-looking keyboard. 3 To the right of the keyboard is a handy guide to key numbers and colour codes.

Prince of Persia and *Head Over Heels*, made good use of the CPC's capabilities. Some games were 6128 exclusives.

Many titles for the CPC were released on disk but some – most notably those sold at budget prices from the likes of Mastertronic and Codemasters – were only published on tape, generally earmarked for play on the 464. Don't worry, though. By hooking a cassette deck to the 6128 via the tape port on the side of the computer, all of those cassettes can be enjoyed, even if it can entail fiddling around with the volume buttons to prevent the game from crashing. You may also find that some games take advantage of the 6128's extra memory. Codemasters' budget title *Spellbound Dizzy*, for example, had more animations, while *Striker in the Crypts of Trogen* loads additional data in the extra 64K of memory before the game starts.



ABOVE The CPC Serial Port allows software to be loaded from a PC.

One thing's for sure, CPC games tended to look good. Done right, developers had a lot of power at their fingertips when compared to other 8-bit computers. They could use a generous palette of 27 colours, for instance, and if they were making games in the CPC's Mode 0, 16 of those colours could be used on the screen at once. The downside was that the 160 x 200 pixel resolution meant the graphics would look chunky, with each pixel having a 2:1 aspect ratio, but they certainly burst with colour.

To make games with more detailed graphics, a good number of game developers compromised and opted for Mode 1, making a trade between fewer colours (four on screen at once) and a higher resolution (320 x 200 pixels). The vast majority stopped short, however, of using Mode 2, which allowed for 640 x 200 pixels but only displayed two colours. This was generally reserved for developers of serious software, although some text adventures made great use of it.

Voyage of disk-overy

As if to show the extent of the CPC's capabilities, modern-day developers have been pushing at the boundaries of the 6128's underlying technology. Spanish demosceners going by the name of Batman Group created a spectacular port of the Amiga classic *Pinball Dreams* in 2019 that boasted smooth scrolling visuals, accurate ball physics and fast action across four tables. They're currently working on a driving game called *Vespertino*, which wouldn't look out of place on a 16-bit machine.

Developers have also been bridging gaps. The 1989 platform game *Toki* never made it to the Amstrad CPC but last year another group, GGP, created a beautiful 6128 version complete with detailed backgrounds and wonderful animation. Their next project is *Mighty Street Fighter*, which may finally put to bed the disappointment felt when *Street Fighter II* failed to materialise on the machine. It promises different fighting styles and eight playable characters.

Games such as these help to keep the CPC 6128 exciting and relevant, extending the life of the computer well beyond its commercial heyday, which ended around 1993. From smooth-running run-and-jump *The Abduction of Oscar Z* and the platform shooter *The Adventures of Timothy Gunn* to the point-and-click adventure *Orion Prime* and a remake of the scrolling space shooter *R-Type* utilising 128K of RAM, the CPC continues to satisfy gamers. It's helped to a large degree by an annual developers' competition called #CPCRetroDev, which attracts dozens of entries.

Playing games and running other software on the 6128 is easy, despite – like on many 8-bit systems – it not being entirely intuitive. When running from a disk, you need to insert the floppy, type CAT, press Return and look at the list of files. If you're lucky there will be just one file, but if there are lots, you're typically looking for one that ends .BAS. You then need to type RUN"[filename].

Tapes run a little differently. First you need to tell the computer that you want to use a cassette by typing |TAPE then you type RUN", press Return, press play on the tape deck and hit any key. Cassettes take an absolute age to load so you may want a huge flask of coffee by your

desk at this point. Read errors are common, too, leading to lots of teeth gnashing and tearing of hair, but that was always a problem with such an unreliable medium.

That's not to say the disk drives never come unstuck. When CPC 6128s age, they start claiming you don't have a disk in the drive, despite your eyes telling you otherwise. This usually means the drive belt needs replacing, but it's an easy enough job (I've done it twice without issue) and the belts can be picked up cheaply online (try **tinyurl.com/APC526belt**).

Trickier to resolve are disks that just won't work. I've found more and more files are becoming corrupted and that error-free 3in disks are rather rare – even the genuine Amsoft CF-2DD ones. When commercial software gives up the ghost, I've managed to find replacements on eBay. But when a disk full of personal documents corrupts, it can be a disaster if you haven't backed it up.

One way of future-proofing the 6128 is to purchase a Gotek drive costing around $100. This floppy simulator replaces the 6128's disk drive and allows you to insert and use a memory stick packed with DSK files (images of physical CPC disks). You just need to find and download these files online using a PC or Mac before saving them to the stick and using it on the CPC. The required DSK image is found by pressing buttons on the Gotek panel, and a display tells you exactly which disk you're working with.

Waxing lyrical

Gotek drives offer a more elegant solution to the method often used in the past: the addition of a 3.5in disk drive. Back then, anyone serious about computing with their Amstrad would have bought a 3.5in drive, mainly because the disks were cheaper and could be formatted to the CPC standard via CP/M+, ensuring they'd work in the exact same way as the 3in variety with a maximum storage of 360K.

It was also possible to transfer files between MS-DOS and the CPC's disk operating system AMSDOS using a program called DOS-Copy; something I did regularly when I was at university. In fact, with the right selection of utilities, the CPC can be turned into a powerful, useful workhorse.

At the very least, grab a copy of the computer's finest word processor, Protext, along with spellchecker Prospell. You can also run spreadsheet and database programs, file managers and DTP apps, the best being Stop Press and PowerPage, which was once a big hit with fanzine editors.

You can even create some stunning pixel art using The Advanced OCP Art Studio or GPaint, or compose a musical chiptune masterpiece courtesy of Soundtrakker or STarKos. While the CPC's sound capabilities were less impressive than the Commodore 64 and its famous SID sound chip, the 6128 still provides three channels to play around with. You could also seek out the The Music Machine by RAM Electronics, which is a digital sound sampling and playback device adding MIDI capabilities.

Room for ROMs

The Music Machine was one of many peripherals created for the CPC. As well as a second disk drive, you can connect a printer with Centronics or parallel ports, which means getting hold of an old dot matrix and then searching for ribbons. Amstrad only added a 7-bit printer port so just half of the CPC's character set can be outputted (unless you fit an 8-bit printer port). You also need to tape over pin 14 to avoid large gaps being printed between every line of text!

You can also use the expansion port, opening a world of possibilities. A great addition is a Multiface II, which lets you view and edit the contents of the CPC's memory, add cheat codes, save screenshots and save tape games to disk. They're not cheap these days and can be hard to pin down, but they're still worth the investment if you want greater control of your CPC.

It's also worth getting hold of a ROM board. These let you insert ROM chips containing programs such as Protext, the assembler language program Maxam and even an alternative GUI-based operating system (SymbOS and FutureOS being the main picks). By entering a command, apps load in a split second. It makes tasks such as operating the word processing much more convenient.

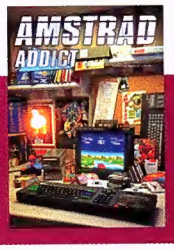
Thanks to a small cottage industry that still surrounds the CPC, you can also pick up other goodies such as extra RAM. There was a time when dk'tronics' 256KB memory expansion was the limit, but you can go much further than that today, with 512KB expansions proving a good buy for around $60 (**tinyurl.com/APC526ram**) and others going up to 4MB.

It's also worth checking out the Universal CPC Serial Interface, which lets you run games and programs on a CPC directly from a PC or the M4 board, created in 2016. This lets you connect a CPC to Wi-Fi to download files, using an SD card as a mass storage device. The latter has become an essential part of my setup, making the workflow of the 6128 feel more seamless in the office.

ABOVE The Multiface II can copy software from tape to disk.

> "When the CPC 6128 was launched in 1985, the computer was riding on the back of the success of the CPC 464, Amstrad's debut machine"

It's all a far cry from the capabilities of the 6128 when it launched, and it shows a steely determination among CPC enthusiasts to keep their favourite machine relevant and usable today. And that's the attraction above all else. Yes, modern machines do everything the CPC can, and so much more, but seeing how far the technology can be pushed just never grows old. And that makes the 6128 a machine to hire not fire, as Lord Sugar would say. ■



David Crookes has edited a one-off special edition of Amstrad Addict dedicated to the CPC. Available now at tinyurl.com/APC526addict.

CHIP CHAT

Joel Burgess reports on the unusual side of tech news

© Nature

21-YEAR-OLD STUDENT DEVELOPS AI TO READ ANCIENT SCROLL

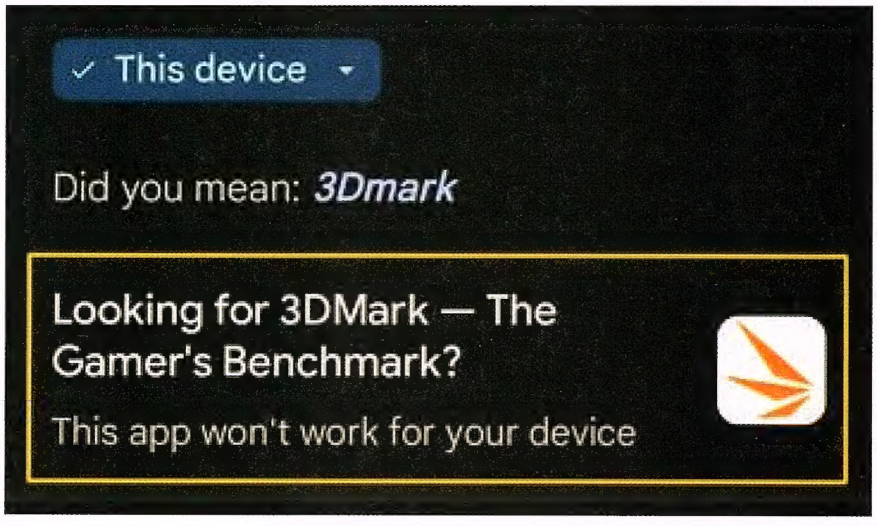
AI DECIPHERS GREEK INSCRIPTION IN CT SCAN OF ROMAN SCROLL.

University of Nebraska-Lincoln student Luke Farritor won a global competition to read the inscription on a carbonised scroll recovered from an archaeological site near Pompeii. The Roman city of Herculaneum was buried alongside Pompeii when Mt Versuveus erupted in AD 79 leaving 600-plus scrolls to be compressed for milenia under 20 metres of volcanic ash in what is believed to be the personal library of Julius Caesar's father-in-law. The team that set up the Vesuvius Challenge have been using CT scans to virtually unwrap the scrolls that are too delicate to physically unfurl and set up the competition to get help identifying text inscriptions.

RING WILL PAY CUSTOMERS FOR FOOTAGE OF ALIENS.

SMART DOORBELL COMPANY WANTS YOU TO USE ITS CAMERAS TO FILM ET.

Are you lucky enough to live in a neighbourhood that doesn't need security cameras? Well Amazon-owned smart doorbell company Ring is giving you a million reasons to install one of its video doorbells anyway. The Million Dollar Sighting competition will give a US-based smart doorbell user US$1 million for an 'unaltered Scientific Evidence of a real Extraterrestrial lifeform' using a Ring camera. The competition was launched just before Halloween, which betrays the company's intent for comical videos (that it won't have to pay for). But it's also likely an attempt to divert negative press for recent high-profile breach of privacy events and contentious use of footage by US authorities.

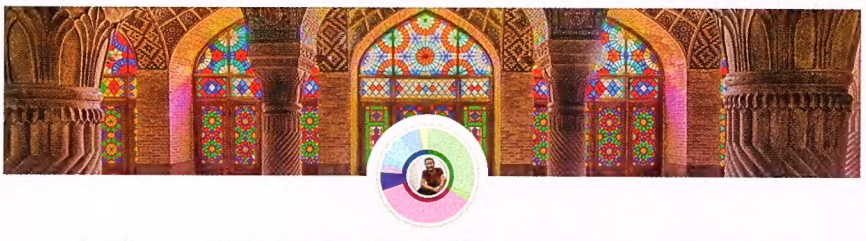


© Youtube - Tech That Out

Google blocks benchmarking software before Pixel 8 launch

'Trust us, our phones are better'.

No company can release technology that tops the charts in every area, every time, but Google has come up with an ingenious (and perhaps never thought of) way to ensure people don't focus on the wrong things when reviewing its latest smartphones... it blocked access to popular benchmarking software. This unprecedented action was noted in a video by YouTube channel Tech That Out! on the 7th of October, showing restrictions on the Play Store to the Geekbench 6 and 3D Mark software. Google did have an October 11th embargo for reviews, and the app restrictions lifted following this, but the device's middling performance makes this behaviour pretty questionable.



Jamie, your DNA suggests that 5.6% of your ancestry is Iranian, Caucasian & Mesopotamian.

From Armenians and Assyrians to Kartvelians and Persians, the diverse people of Iran, the Caucasus, Eastern Anatolia, and Mesopotamia share an ancient genetic history dating back to some of the world's first farmers.

HACKER SHARES GENETIC CODE OF MILLIONS OF 23ANDME USERS

HOW TIGHTLY SHOULD WE GUARD OUR GENETIC BLUEPRINTS?

A hacker with the callsign Golem has released the unalterable DNA profiles of millions of users subscribing to ancestry startup 23andMe. The company responsible for the retail DNA set that won *Time*'s 2008 'invention of the year', suffered a breach in October following a credential stuffing campaign against users that had used common passwords known to be already compromised. The genetic data that could theoretically be used to plant fake genetic information was posted to known cybercrime hub BreachForums. The hacker noted that the dataset includes UK users and the 'wealthiest people from the US and Western Europe' according to a *Tech Crunch* report.

© 23andMe

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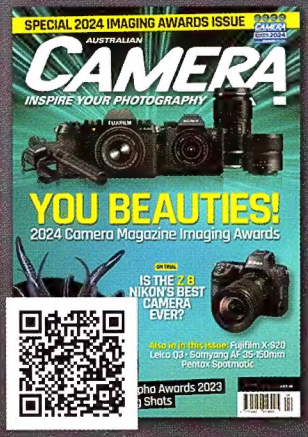

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